March/April 1995 Issue #43

Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

in this issue

features

reviews

user reports

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FCC Releases Vanity Rules

The Federal Communications Commission has released the details of it's plan to implement so-called vanity callsigns to radio amateurs. The commission's new computer system will continue to assign call letters in the traditional consecutive sequence, however soon the FCC will be able to accommodate those who desire a callsign of their own choosing according to a system of four starting gates:

Gate one would allow a previous holder of a callsign to apply for that callsign, or if the holder is deceased, a relative could apply.

Gate two would allow the 66,000 Amateur Extra Class operators, having passed the most difficult of amateur exams, to apply.

Gate three would allow the 112,000 Advanced Class operators, having passed the second most difficult exam, to apply.

Gate four would open the system to any licensee, including a club station license trustee, to apply for the callsign of a deceased former holder.

The FCC is expected to announce the opening of each gate by means of a public notice. First, the commission must prepare the new application—Form 610-V. The Notice of Proposed Rulemaking for the personalized calls was adopted way back on December 13, 1993. A fee is expected to be charged for the privilege of holding a vanity callsign. *TNX W5YI Report, Feb. 1, 1995.*

Amateurs Help Victims

According to the ARRL as reported in the *Ham Arundel News* More than 200 hams were key contributors to emergency communications in earthquake ravaged Kobe, Japan recently. On January 16, the major temblor shook Kobe's metropolitan area, killing more than 5-thousand and leaving tens of thousands homeless.

Amateurs and their radio stations have been instrumental in connecting relief centers and providing information on road conditions and traffic, health and welfare, and the availability of food and water. Hams have also been key in helping residents locate missing loved ones.

Some two hundred hand-helds were provided in cooperation with the Japanese Amateur Radio League and the Japan Amateur Radio Equipment Industry, at the request of the Ministry of Posts and Telecommunications. In addition to the 430 and 1260 MHz HTs, three repeater stations were supplied by JAIA member companies for the rescue operation. *TNX ARRL; The Ham Arundel News, February, 1995.*

Get It Together

Here are Sam Barnes (L) and Danny Gold KD4HQV (R) putting some finishing touches on their Max Systems 5 element quad for 2 meters. See the review on page 6. (Photo by Jeff Gold AC4HF.)

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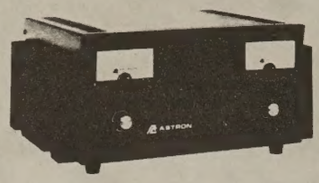

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SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
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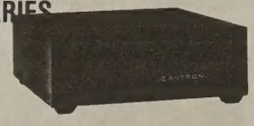
SL SERIES



- LOW PROFILE POWER SUPPLY

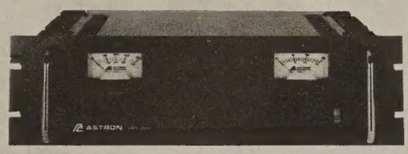
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

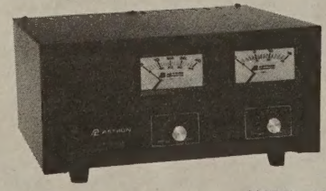
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

QLF

by Wayne Green W2NSD/1

Living Longer

You've probably been too busy rag-chewing on your local repeater to watch TV. Well, for the most part, that's okay. But the downside is that you've probably missed some very interesting programs on longevity. That may not be important to you until you reach your sixties, but I guarantee that programs like that will demand your attention once you start getting senior citizen discounts and are beginning to think in terms of getting some of that Social Security money back you've been donating to the government for Congress to waste for you. Donating? Sure, or go to prison.

One thing the scientists have proven, you tend to live a lot longer and healthier if you are busy doing and learning new things. Couch potatoes and big-bottomed rag-chewers are among the first to go. Well, that's okay, since we'll never miss most of them. They're contributing zilch to society.

Amateur radio, the hobby with 73 different flavors, has endless excitement and fun to offer. And these two ingredients do wonders for your immune system, helping to keep you young and healthy.

Step one: Join me on my crusade to make amateur radio more attractive to newcomers by getting rid of the code requirement for the Novice, Tech, and General Class licenses. Well, almost rid of it. I don't mind the 5 wpm test, as long as testees are allowed to use the Wayne Green system for mastering the code in one hour. Actually, it's more like 15 minutes, but I like to allow for the mentally deprived. Equal opportunity, and all that.

Step two: Pick a challenge. Let's say that you decide to go for ham satellite communications. Okay, start checking back through your *73* library for articles on how to get involved. You're going to need a receiving converter, a transmitter, a satellite antenna, and a computer to keep track of where and when which satellites are passing.

When I decided to get involved I went for one with an input on 450 MHz and output on 2m. I already had a good 2m receiver, so all I needed was the antenna and a transmitter. I bought an up-converter for sideband and fed that into a 50-watt amplifier I borrowed from WA1KPS. The antenna is a little tricky because it's nice to be able to both rotate it and elevate it. That takes two rotators.

The next thing you know I was tuning the 2 meter satellite channel, listening for my signal to come back from 450 MHz. Now, that's exciting! Suddenly I was able to talk with hams all around Europe, Canada, the US, and northern South America. As I've mentioned before, Moscow was at the far reach, with only a 20-second window open, and that only when the satellite was in exactly the right spot on my far horizon. Yep, I made it! Talk about getting excited!

Satellite communications isn't difficult to do, and it'll probably add at least two or three years to your life span. Unless, of course, you smoke, in which case never mind. Actually, it'll add a lot more than a couple years, because you'll be setting up a pattern of getting involved in new things, in which you'll be too busy having fun to get sick or die. Next you may tackle packet radio, and why not, since you can send packets via our satellites now to anywhere in the world?

If you've invested in a good tower and beam, let's see how fast you can work 100 countries in the next DX contest. Run your *own* contest. Let's see if you can beat old Uncle Wayne. I did it on 20m SSB in one weekend. I worked all continents in 40 minutes one time, but that was back in 1947 when I was in college and had my ham shack set up in the basement of my fraternity house. I had a great setup, with a 75m AM kilowatt rig I'd bought from another ham, and an all-band pp-813 kilowatt rig that I'd built myself. After talking with four stations in a round table on 20m one morning, I suddenly noticed that we were all on different continents. Hmm, all I needed for WAC was Asia, so I called CQ Asia and a chap in Jakarta came right back. Bingo!

Working 75m DX is a little more tricky. I got a lot of my countries by contacting DX on 20m and asking them to come down to 75m and listen for me. All I had was a sloping twin-lead dipole, but it did fine. I racked up the countries easily that way. How good a signal did I have? When I was visiting VK3ATN in Australia we contacted W2NSD/1 on 20m, where my rig was pouring in a 9+ signal. We decided to try 75 and see if we could hear my station. I couldn't believe it, it was coming through 9+ there too, and that was halfway around the world!

I was visiting Ray to see his 2m moonbounce antenna, which was most impressive. We borrowed a plane so I could take pictures of it. And it worked, too. That's right, Australia to the US on 2 meters via moonbounce! Maybe you should buy a farm where you have some room for antennas. But not near my farm, okay?

Use It

The sorry fact is that we amateurs aren't using even 1% of our frequency allocations. Check it out. I counted about 0.138% of our allocations getting any significant use. And the frequencies we *are* using we are using so wastefully that it should be a crime. We're still using 1955 technology (sideband) in the digital age. With digital voice and compacting algorithms we could squeeze a dozen times as many contacts into the same bands, and with less interference. Far less.

But when we stopped the growth of the hobby 33 years ago we froze out the youngsters our infrastructure had been bringing us, and these were the hams who were doing most of the inventing and pioneering, not the old codgers. Jack Babkes W2GDG was only 25 when he started pioneering narrowband FM. Copthorne McDonald wasn't much older when he pioneered slow-scan TV.

We need youngsters to help us pioneer our microwave satellite bands. We need them to help get us out of the 1930s CW mindset, into digital voice, and our own version of the Internet, only using ham satellites. Today it would be easy to communicate at 50,000 words per minute, complete with automatic translation into any language in the world. Instead we're busy fighting ourselves over the code, repeater channels, and who can be the most obnoxious on 14,313 . . . with no winners possible.

Twenty-five years ago I had one heck of a battle with the old-timers when I tried to get my readers to give 2m FM and repeaters a try. I set up my own repeater in 1969 on top of Pack Monadnock. It allowed mobile hams on Cape Cod to talk with others way up in Maine. It took awhile, with the old-timers fighting every inch of the way, but gradually the flood of articles I published, the repeater symposiums organized around the country to get the repeater owners to coordinate frequencies, the books, and a repeater newsletter got hams to give repeaters a try. Within five years 2 meters became the most active ham band in the world. You have to be persistent. Never Say Die.

So start making yourself younger, healthier, and stronger by tackling new ham horizons. And for heaven's sake, let me see some articles on what you're doing. Whether you get involved with DXing. packet, satellites, foxhunting, etc., I want to use the story of your fun and success to get others excited. I'd love to see someone beat my record of seven states worked on 10 GHz. It's about time. And I guarantee that if you do, you'll have one heck of a story to tell at hamfests, in articles, and to your grandchildren. Great-grandchildren too, because you'll probably live that long. RF

Ham Newcomers—Welcome

by Wayne Green W2NSD/1

To help you get started in this 73-division hobby, you'll be getting one or two gratis copies of *Radio Fun.* The sneaky plot is to (a) help get you interested in the incredible number of hobbies that make up amateur radio; and (b) to try and get you addicted to *Radio Fun,* and maybe even interested enough to check out the mother ship, *73 Amateur Radio Today.*

Amateur radio can be the springboard to a high-tech career for youngsters. That's what happened to me. And it can be a wonderful friend for older people. There's no such thing as being lonely when you have a ham ticket.

I used to have a ham shack way up on the side of Mt. Monadnock in southern New Hampshire. I was loaded for bear with an AM kilowatt on 2m and a 336-element beam, plus I had towers and big beams for 6, 220 MHz, and 450 MHz. And not a bad signal on the low bands. So I could sit there in my cabin on the mountain and talk anywhere in the world. Or I could turn off the switch and be totally alone with no one else within miles. Both are nice, and the option was mine. Some time I'll tell you how the ARRL forced me to lose my fantastic DX location.

A few days ago I made a business trip to Florida to do an article on the first cold fusion reactor to be issued a patent. While I was there I naturally called in on the local repeaters, looking for some company for a chat. I found three repeaters coming back to my kerchunking. Two produced no answers to my calls through most of the week I was there. The third got me into the middle of a heated religious argument over abortion. Since I have strongly-held ambivalent ideas on the subject I broke in and suggested that it wasn't very fruitful to get into heated religious arguments. The irritated response was that this had nothing to do with religion because the Bible backs up the anti-abortion stand.

Another time I ran into an old timer who, on his first transmission, mentioned three times that he was legally blind, and then went on to list his other disabilities. I remember a ham in Brooklyn who used to endlessly draw on sympathy with his legally being blind, which he mentioned frequently. He suggested that this was a good reason for the local hams to give him equipment. I'd recently built an SSB exciter and moved on to a Central Electronics unit, so I gave him my old rig. I think he sold it.

Radio Fun

There's infinitely more to amateur radio than prattling about nothing or getting off on some religious theme on the local repeater. We have endlessly fascinating things you can do and learn. For instance, if you get hooked on radio teletype, you'll learn a lot. That's a digital mode, and digital is in these days, in a big way. Then there's slow-scan television, complete these days with high definition color photos being swapped by hams all around the world. DXing can be fun if you don't get too caught up in some foolish certificate nonsense. Even more fun is packing up a small rig and heading for the Caribbean or someplace reasonable rare.

On 2 meters, in addition to those thousands of mostly unused repeaters, there are a bunch of people having a ball on sideband. There are others just waiting for the aurora. And some are making moonbounce contacts. Some of the ham satellites are on 2m too. You can even hear them with a handie-talkie.

For a crummy $12.95 a year you can get a monthly shot of excitement and ideas when you subscribe to *Radio Fun.* We'll have a few simple construction projects, an editorial by me for you to love or hate (and I don't care which), and an update from our regular columnists. Don't be a cheapskate.

With amateur radio technology being mostly being in the antique wireless days, the hobby is wide open for anyone interested in experimenting or pioneering new modes. We need to have work done in narrowing bandwidth, as they are doing with TV. We need to digitize voice and compact it. One ham invented and patented a way to put a whole TV signal on a broadcast radio AM carrier without it being heard by the regular listeners.

It's about time for our ham rigs to have automatic identification chips built in and receivers that can tune for the prefix or even call we're looking for. In my *73* editorials I go into more depth on areas where hams have the most potential for pioneering.

That Code

Yes, I know all about the code being a ridiculous barrier to getting the General ticket. But I also know that if you use the right method you can learn the code in just a few days at either 13 or 20 per. I have a little booklet that explains how you can pass that dumb 5 wpm code test after less than one hour of study. Guaranteed. And it also explains the only known method for mastering the higher speeds in the shortest time and without ever encountering the infamous plateau at 10 wpm which has turned millions of potential hams away from the hobby. You can learn this way using your computer or by getting some of my $5.95 practice tapes.

I'm going to need your help to get the FCC to drop the code requirement, so stick with me. Details at eleven, as they say. RF

Power Transformer Primer, Part 2

by Robert C. Green W3RZD

In last month's *Radio Fun* we learned how transformers are built and how they are rated. Now we are going to find out how to test them and discuss some different ways they can be connected.

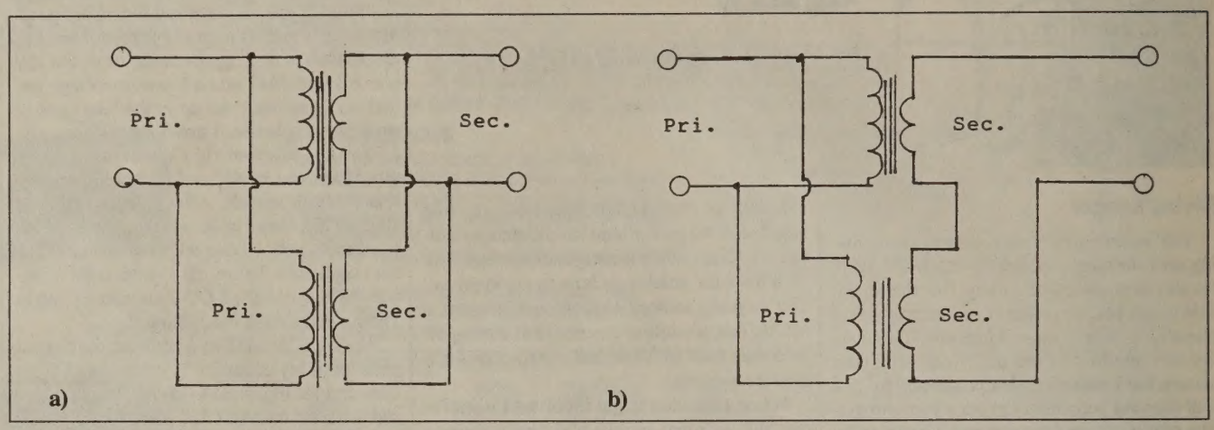


Figure 1. A) Transformer secondaries in parallel. B) Transformer secondaries in series.

Preliminary Steps

Before any transformer, new or used, is put in service it should be checked for continuity and shorted windings, and the easiest way is with a volt-ohmmeter. Before making any checks, heed some words of caution: *Don't* connect the transformer to the power line until all ohmmeter tests have been made. Use insulated jumper leads with insulated alligator clips between the transformer and the meter probes. Keep your fingers on the insulated clips when making any connection, even a simple ohmmeter check. It is possible to get a shock when an ohmmeter is disconnected, which is caused by the inductive "kick" built up in the winding by the ohmmeter's battery. Before making voltage checks *be sure* the meter is not on any ohms range, and is set for AC volts, not DC volts. Be careful checking voltage as you could by accident get on a high-voltage winding. Also, *always* disconnect the primary from the power line when secondary connections are being changed.

The ohmmeter should be set on a scale that will allow reading to three places. For example: If the resistance is actually 230 ohms, you don't want a scale where you aren't sure if the resistance is 210 or 250 ohms. A digital volt-ohmmeter is the best type to use as most meters read to three or four places with accuracy.

Before making any tests, each lead or lug on the transformer should be marked. One way is to use assorted colors of electrical tape, such as in the package sold by Radio Shack under stock number 64-2340. Wrap a 1/4" strip of a different-colored tape around each lead. If there are more than five leads, use two colors on the remaining leads. In place of the colored tape, small strips of masking tape can be used and marked with a number or letter. If the transformer has lugs instead of leads, use a dab of model airplane or hobby paint, which is made in a wide variety of colors. If you wish, use a dab of paint on the masking tape. Sometimes a drawing of the leads or lug position is helpful. When a transformer is already marked as to its primary and secondary, it's a big point in your favor. Usually, but not always, the primary will leave the housing on one side of the transformer and the secondary on the other side. Also the primary leads may be of a different color (probably black) from those on the secondary side.

Readings can vary between transformers that may appear identical. If you plan to use identical transformers check the stock or part numbers on both to confirm they are identical. Seldom will different manufacturers have the same part or stock number. If the transformers are identical the readings between the two should be within 1%-2%.

Ohmmeter readings will give an inkling as to which winding is being measured. A primary will probably have a resistance of between 80 and 350 ohms. A high-voltage secondary may be between 300 and 600 ohms, depending on the rated output voltage and current. A low-voltage secondary may give a reading from zero to 4 ohms. Resistance values of low-voltage windings can cause confusion; the low reading can look like a short circuit or shorted turns. The final check of a low-voltage winding will have to be made with a voltmeter. A center tap on any winding may have a striped lead, or be marked in some other manner. To be sure it is a center tap, check that the resistance between it and two other leads is the same.

A resistance check should also be made between all leads and the core to determine if a short is present. When making this test be sure the ohmmeter probe is making good contact with a bare spot on the laminations—you will need to scrape the varnish or shellac from a small spot to make a good contact. After checking for core shorts on one side of the transformer, turn it over and repeat the test on the other side of the core.

Suppose that in this test you find one winding has an end-to-end resistance of 100 ohms, and you also find there is a 20-ohm reading from one end of the winding to the core. This could indicate a short, but to double-check, measure from the other end of the winding to the core. If there is a short, the resistance would be 80 ohms. *If you are certain there is a short you have a potential deathtrap. Don't use the transformer.*

Using Secondaries

So far we have talked about using just one transformer for a particular job, but what if that transformer doesn't have the required current or the voltage? If so, then another transformer's secondary, or secondaries, can be wired in parallel or series to give the wanted output. Secondaries can be connected in parallel to increase the current and connected in series to increase the voltage, or can be connected in a series-parallel combination.

When transformers' secondaries are connected in series or parallel there are some rules that have to be observed. Rule 1: When connected in parallel to increase output current, the voltage of each secondary *must* be the same. Rule 2: When connected in series to increase the voltage, the current drawn must not exceed the current rating of any secondary. Rule 3: If a series-parallel combination is used, both Rules 1 and 2 must be observed. The new secondary that results can be from a single transformer with multiple secondaries, or the secondaries of several transformers, or a combination of both.

Rule 4 states that all secondaries must be phased correctly. Phasing is making sure that one end of a secondary will be of the correct polarity when it is connected to an end of another secondary. When a transformer is energized, each winding has a negative and a positive end, but this polarity lasts for only a fraction of a second before it reverses and changes ends. The speed at which the ends change polarity depends on the frequency of the alternating voltage on the primary winding.

Another way of explaining phasing is to assume we have two transformers and each transformer has one secondary. The secondary of one transformer we will call A; the secondary on the other we will call B. The ends of each secondary will be labeled #1 and #2, and we will also assume that the transformer primaries have been connected in parallel. You want a series connection and are thinking of connecting end #1 of secondary A to end #2 of secondary B. Will this be correct? It will be if at the

Continued on page 7

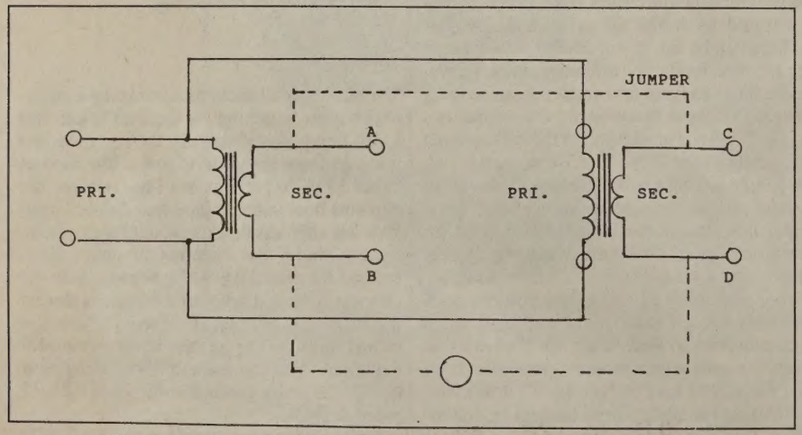


Figure 2. Checking the phasing for parallel secondaries on non-identical transformers.

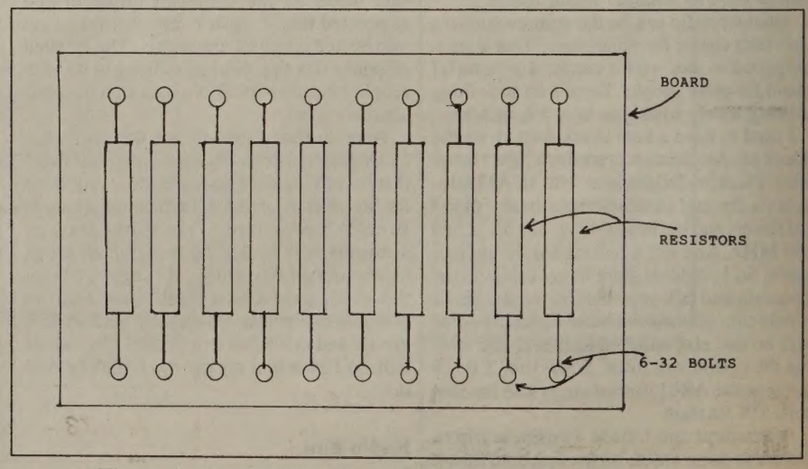


Figure 3. A variable load made from non-inductive resistors.

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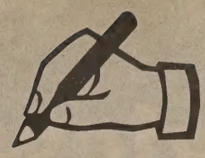

Howard E. Proud KB8PAO, Cincinnati OH In the top right corner of page seven in the September 1994 issue of *Radio Fun* there is a brief reprint of a June 6, 1994, release by *Westlink*, report No. 673, saying that the date has not been set for the Amateur Radio Industry Association proposal to lower the General Class code speed requirement to 10 words per minute. I think this is a good idea.

I recently got back into amateur radio (formerly WN8DZX) and my Novice license shows an effective date of 06/08/93. My Technician was effective 08/24/93, and my General shows an effective date of 08/31/94. I'm very happy with these privileges and enjoy working 40 meter CW, where I meet a lot of hams 65 or older. I am now 76, retired and loving it.

There are still a lot of us out here who like CW and I hope that it is never abolished. I do agree with the 10 wpm proposal and trust that the FCC will support this.

Sylvester Sneider AH6HH, Kailua HI Wayne, I just finished reading your November 1994 "QLF" column and had to write to tell you that I can't agree more with your views on CW and eliminating the Tech-Plus Class license.

I will be circulating your petition within our small Koolau Amateur Radio Club in Kaneohe, Hawaii, and will be contacting the Honolulu Amateur Radio Club as well.

I am taking it upon myself to join your crusade and will forward copies of signed petitions to you as requested.

[Editor's Note: In the review of the Azden 7500H in the January 1995 issue, page 11, the street address was listed incorrectly. The correct address is 147 New Hyde Park Road. RF

Emergency Center To Link Ham Radio With Internet

Plans for what organizers call "the world's first public emergency communications center" have been announced by a Colorado amateur. John Hart N0OCF of Lakewood, CO, says he is starting the "E-COMM" communications center as a non-profit organization to link amateur radio with the Internet worldwide to expedite emergency communications among disaster victims, family, and friends.

"The concept of E-COMM is simple," Hart said. "If you are in a city where disaster strikes, or if you are experiencing an individual emergency, E-COMM will pass a health and welfare message, anytime day or night, to your family and friends, wherever they reside, even if phones are down and power is out . . ."

Getting a message to E-COMM is accomplished in cooperation with ARES, the Amateur Radio Emergency Service. The new emergency center plans to form a strategic alliance with ARES operators and groups. Those operators and groups are expected to be listed in city directories and other databases.

The new communications center to be built in Lakewood, Colorado will include HF, VHF, satellite, packet, an e-mail server, an ftp server, and a WWW server all connected to the Internet. For more information you can contact founder John Hart directly at *E-COMM, Inc., 767 South Xenon Court, Suite 117, Lakewood, CO 80228; (303) 987-3246, FAX (303) 987-3246, or Internet: jhart@teal.csn.net.*

Thailand Celebrates Communications Day

On 4 August, 1994, Thailand celebrated its National Communications Day. The theme of this year's celebration "Communications for a better life of the Thai people" was celebrated by speeches, tributes, an exhibition, a two day seminar—attended by both local and foreign participants—the issuance of commemorative stamps, first day cover and the distribution of commemorative books. *TNX Newsletter of the ITU.*

Mighty Microwaves From Denmark

According to Steen OZ9ZI, it was a surprise to learn after the Danish Microwave Activity Week 1993 that what they thought was a world record on 145 GHz had been broken almost before it had been set. The aim was to set a new record in the course of the D. M. A. Week 1994 but the weather did not permit this. Therefore, a decision was made to attempt the new record as soon as the weather improved.

Organizers selected a distance of 11 km over Arreso which had been previously used for the first 10 GHz tests back in 1983. A talk back frequency of 47 GHz was eventually agreed upon.

The SSB QSO was carried out on 02-07-94 at 16:30 GMT with a 5-6 / 5-7 report. Stability was surprisingly great—the frequency difference was only 146 kHz in relation to the estimated difference, and the frequency drift was acceptable.

The following equipment was used for this feat: DB6NT's 12 GHz injection chain and doubler/amplifier (12/24 GHz) and a double-balanced harmonic mixer with four Russian-made diodes. Transmitter output was -7 and -9 dBm, the receiver noise figure 13 dB. The aerials are 25 cm Procom dishes with a backfire feed system. According to OZ1UM's calculations, these stations should be able to transmit 60 kM! *TNX OZ9ZI.*

A look at the 145 GHz equipment used to set a new world distance record.

RF review

Max Systems Inc.
4 Gerring Rd.
Gloucester MA 01930
Telephone: (800) 487-7539
Price Class: $59.95

Max Systems' Five-Element Quad

by Jeff M. Gold AC4HF

When *Radio Fun* asked me to review a 2 meter five-element quad for their magazine I thought that it was very appropriate, considering the large number of new codeless Technicians. As I thought of the best way to approach the article, a fun idea came to me. My son Danny KD4HQV is 11 years old and has had his ticket for about three years. An antenna of this type should be a good and fun project for him. A friend of Danny's, Sam Barnes, who had shown interest in ham radio during his many visits to my house, was going to come over during the Christmas break. What a great project to do with two energetic youths!

I decided that if this was going to be a true test of setting up the antenna, I would be there but provide support only when absolutely necessary. This is an important point: 11-year-olds tend to get frustrated easily and many times would rather give up than solve a problem.

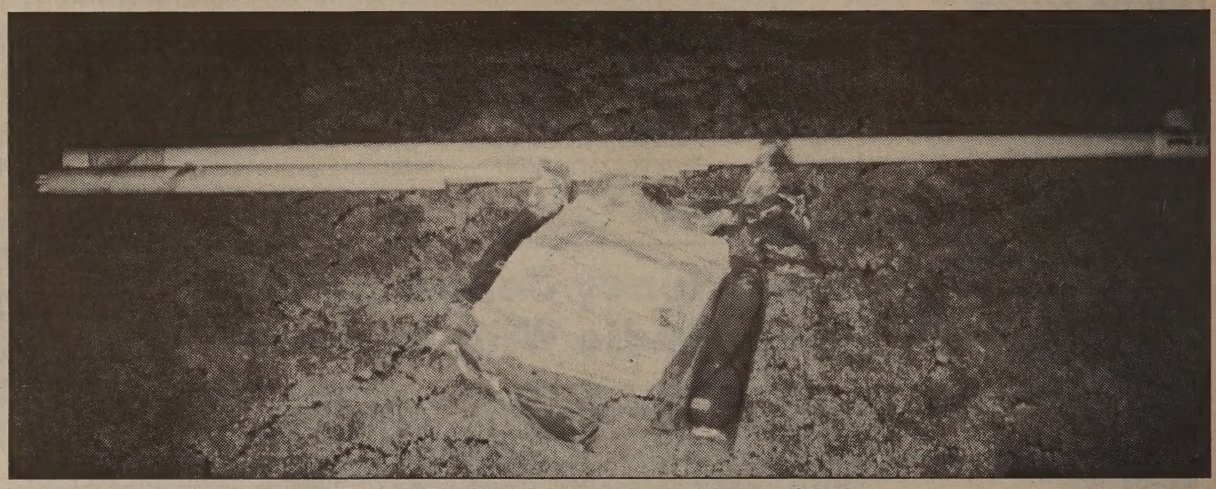

Photo A. The Max Systems' quad, right out of the box.

Assembly

The boys sat in my living room with the instructions. They separated the parts and started to build the antenna. The parts were clearly labeled. I did intervene when I noticed they were having some problems with measuring sixteenths on a ruler marked in eighths. I believe this was probably due more to the fact that they were trying to get out of the project at this point than to a true inability to figure out how to do the measurement.

After working on the project for a short while they started to get somewhat frustrated. My son was complaining that the instructions were unclear. Knowing that he has read and followed many sets of instructions in the past, I knew that either he was telling the truth or his attention span had reached the maximum. After trying to persuade the boys into doing the job 100% on their own, and having exhausted all my psychological tricks, I took the instructions from them. The instructions are a little over a page long. The first half of the instructions are clear (the boys didn't have any trouble with this part). The instructions after this point were a little unclear, but not terrible. Many companies that publish instructions put them together themselves. When you know how to build an item and then go on to explain to someone who hasn't done it before how to do the job, it becomes very easy to take things for granted and not explain things clearly enough. A couple of illustrations would have easily cleared up the confusion.

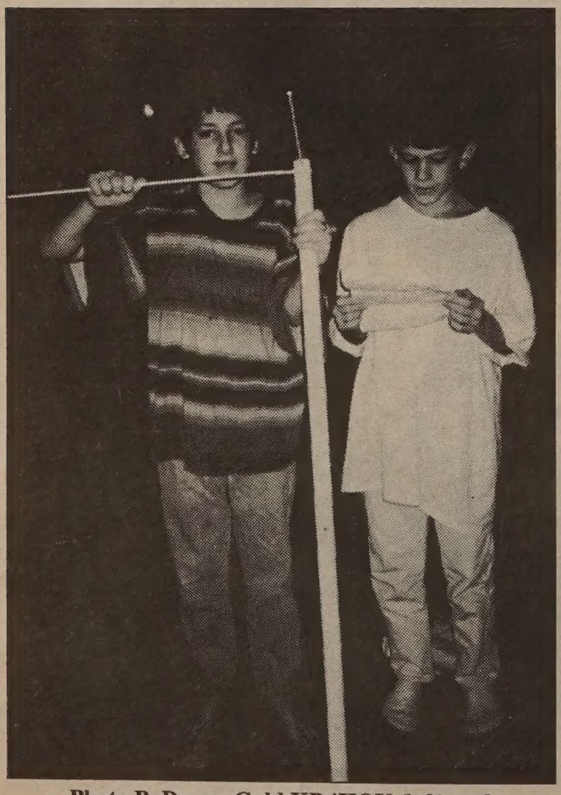

Photo B. Danny Gold KD4HQV (left) and Sam Barnes (right) begin assembly.

With a little explanation from me, the boys easily finished the project and were quite proud of their accomplishment. After looking at the finished project I realized that it was in fact a very easy-to-build antenna. It would be very easy to take the antenna apart and reassemble it for portable use. With a little more reading of the instructions, anyone should be able to put it together easily. To put it together, all you need are a tape measure, a pair of pliers, a screwdriver, and a pencil. To put the antenna into operation you will also need a 50-ohm coaxial cable terminated with a PL-259 connector and some silicone sealant and plastic tape to seal the PL-259 connector that will be outside.

The antenna booms are rigid, thin-wall PVC pressure tubing. The spreaders are strong, stiff, pultruded Fiberglas rods. The elements are preformed, closed loops built of 14-gauge, 168-strand "Flex-Weave" from Davis RF. The design appears rugged and mine has already weathered two heavy windstorms and a bad ice storm. An 18-inch PVC pipe mounting mast is provided. The company sells the antenna

Photo C. The 11-year-olds with the completed quad.

with an unconditional guarantee with no time limit.

Performance

Well, all this is just fine and dandy, but how does it perform? The weather was starting to get bad, but I decided to put the antenna up in the air anyway. I had an extra coax on my tower that was already routed into my shack. I figured with the coax part already done, the rest would be easy. I didn't have a clamp to attach the mast to the tower, so I devised one from parts in my shack. The weather was pretty bad and it was getting close to darkness so I decided to put the antenna up at about 20 feet, which meant I could climb the tower and stand on the roof to do the work.

I managed to attach the antenna before my hands were totally frozen. I went inside the house and connected an HT to the antenna. My first test was just to see if the antenna did anything. I put a call out on one of the local repeaters and had no difficulty. I tried a second repeater with the same results. It was time for a real test. The local university club (WA4UCE) has just received a grant to get a new repeater. The old one has just about had it—you can usually reach it on or near campus, but get a couple of miles away and it can become a problem. I have trouble getting into it from home with my five-element yagi. I called on the repeater and got a full-scale reading when someone came back to me. I next programmed in a repeater that was located some distance away. I had no problem getting into it with less than 2 watts. The boys were quite excited to see that the antenna they had built worked so well.

I measured the SWR of the antenna across the band. My measurements showed the SWR to be better than advertised. I think the antenna performs very well, and it is rugged and lightweight. It was easy to assemble even with the shortcomings of the provided instructions. RF

Specifications

Frequency Range	144-148
Gain/jFB	11/25 dB
SWR 144-148	1.01 min-1.8 Max (*mine measured 1.4 max)
Boom Length	57"
Boom Diameter	1.3"
Turning Radius	32"
Surface Area	0.7ft.
Weight	3 lbs.
Matching	Direct 50 ohms
Max Power	500 watts

See page 32 for a great deal.

Power Transformer Primer, Part 2

Continued from page 4

instant that end #1 of secondary A is positive is the same instant that end #2 of secondary B is negative. If end #2 of secondary B is positive instead of negative the voltages of the two secondaries will buck each other instead of adding.

Now, for a parallel connection, the instant that end #1 of secondary A is positive must be the same instant that end #1 of secondary B is positive. Thus, each #2 end is negative at that same instant. Secondaries connected in series or parallel are shown in Figure 1.

Figure 2 shows a simple method of checking the phasing for parallel secondaries on non-identical transformers. When making this test remember to disconnect the primary from the power line when changing any lead. First connect the primaries in parallel. The second step is to connect a jumper from lead A to lead C. Connect the primary to the power line and, using an AC voltmeter, read the voltage between leads B and D. The secondaries are in phase if the voltmeter reads zero or near zero. However, if it is not zero read the voltage between A and B or C and D. If the first voltage between B and D is about twice of either second voltage reading, the secondaries are out of phase for a parallel connection, and are in series. If they are in series, to parallel the secondaries it will be necessary to reverse the leads on *one* secondary.

After the secondaries have been wired in series or parallel, a voltage check should be made across a load that will draw the wanted current. A load made of noninductive resistors is ideal. Noninductive resistors can also be used in checking the output of audio amplifiers, so they are a good investment. Radio Shack has 8-ohm 20-watt noninductive resistors under stock number 271-120. Eight or 10 resistors connected in series or parallel, or a combination, will handle just about any transformer we want to check, plus a lot of amplifiers. The resistors can be mounted on a piece of wood as shown in Figure 3, with each lead connected to a 6-32 machine bolt. By using jumpers, a variety of resistance and wattage values can be obtained.

To see how the resistors are used, assume there are two 12-volt secondaries rated at 3 amperes each, and they have been phased and connected in parallel. This will give an output of 12 volts at 6 amperes. Ohm's Law tells us that 12 volts divided by 6 amperes is 2 ohms, the value of the load. The wattage rating needed for the load resistor is 12 volts multiplied by 6 amperes, or 72 watts. Remember that resistances in parallel decreases while the wattage increases. If the resistor load board has been built we can use it and parallel four of the 8-ohm resistors. This will give 2 ohms at a wattage rating of 80 watts. Connect the resistors across the new secondary, and then connect the primary to the power line. Be sure the voltmeter is set to read AC volts before reading the voltage on the secondary. The voltage should remain at 12 volts. The resistors will get warm if connected for a long time and could increase in value, which would change the output readings.

When the same secondaries are connected in series there will be a problem with the resistors; the wattage rating will be too low. Again, voltage times current shows there will be 72 watts. The load resistor needed is 24 volts divided by 3 amperes or 8 ohms. Each resistor is only rated at 20 watts so it will be necessary to use as many resistors in parallel as we can to increase the wattage and still have 8 ohms. Two 8-ohm resistors in parallel will give 4 ohms. If these two resistors are connected in series with two other 8-ohm resistors that are in parallel there would be a total of 8 ohms at 40 watts. The wattage rating of resistors in series will not increase as they do in parallel; however, the 40 watts will allow a quick check on the output.

Figure 4 shows secondaries connected in a series-parallel combination. Our imaginary transformer has three secondaries; two are 6 volts at 6 amperes and the third is 12 volts at 6 amperes. The desired output is 12 volts at 12 amperes. First the two 6-volt windings are connected in series to give 12 volts. Then this pair of windings is phased with the remaining 12-volt winding and connected in parallel. In this example one transformer is used but there could be two or even more transformers, with their primaries connected in parallel.

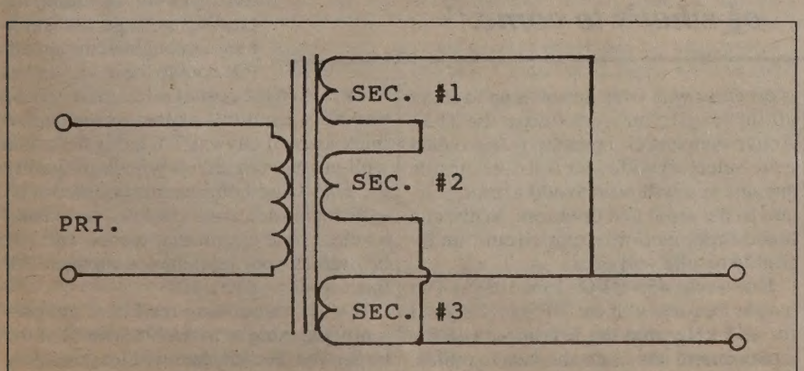

Figure 4. Series-parallel secondaries.

Primaries

So far we have been using transformer primaries in parallel, but there are times when they have to be placed in series. Perhaps you have built an electronic kit that could be used on either 120 volts or 240 volts. If you have, you probably saw on the schematic that there were two primaries on the transformer but only one set of secondary windings. The instruction manual stated that if the equipment was to be used on 120 volts both primaries were to be connected in parallel, and if used on 220 or 240 volts, the primaries were to be connected in series.

Let's see why this is done. Suppose we have a transformer with one primary and two secondaries: one secondary to be used when the primary is connected to 120-volt power, and the other when the primary is connected to 240 volts. When used this way only one secondary will ever be connected; the unused secondary becomes unneeded and unwanted, and unless connected to a load it will "float." A floating secondary is unwanted as it can cause trouble, and it can be dangerous.

Now that it's decided to have one secondary, what would happen if there was one primary winding? If a 120-volt primary is connected to 240 volts the output voltage on the secondary would be doubled. To keep the secondary voltage the same as it was for 120 volts input, either the number of turns on the secondary would have to be reduced by one-half or the number of turns on the primary would have to be doubled. The answer is to have two identical 120-volt primaries that can be wired either in series for 240 operation, or in parallel for 120-volt operation.

When operated on 120 volts, *both* primaries should be wired in parallel. There is another reason why both primaries should be wired in parallel: In all probability each primary winding is wound with a size of wire that is capable of carrying only one-half of the total primary current. This is done for economy and to save winding space.

To prevent confusion, the transformer manufacturer has phased the two primaries and labeled the leads of both as to which is the start and finish. The primaries can be tied together inside the equipment, or brought to a recessed terminal strip on the rear panel, and jumpers used to make the connections. To ensure safety the terminal strip is covered by a protective plate.

When dealing with any power transformer make sure a primary is a primary before connecting the transformer to the power line. If by chance a low-voltage secondary is put across the power line it will probably blow a fuse, if the line or equipment has a low-amperage fuse. Don't cuss, just be thankful. You will know something is wrong and look for the cause. If there isn't a fuse or if it is of high amperage, the winding will probably burn out. But before it does, the regular primary will have become a very high-voltage secondary, and the regular high-voltage secondary winding will become even higher. Assume the secondary that was connected to the power line was wound for 12 volts, which makes the voltage ratio between the primary and the secondary 120 to 12, or 10:1. When the 12-volt secondary is connected as a primary the ratio is reversed and becomes 1:10. The regular primary is now a secondary that has 1,200 volts across it. The output of a high voltage secondary would also have been increased by the same ratio, and could have thousands of volts across it.

Checking out power transformers isn't difficult or dangerous if you just take your time and use common sense. Transformers will last for years if used correctly, and you can last for years if when you check or use them you do so correctly. Don't take chances. RF

RF review

T-Kits
Ten-Tec, Inc.
P.O. Box 8010
Sevierville TN 37864
Telephone: (615) 453-7172
Price Class:
PN 1552 Active Antenna $12;
PN 1050 Universal 455 BFO $9.

T-Kits by Ten-Tec

by Don Johnson K7UGQ

It has literally been decades since many of us electronic hobbyists have been able to enjoy kit building. The likes of Heathkit, WRL, Knight-Kit and Eico have come and gone. Serious kit building was an alternative way to acquire top-of-the line equipment at an affordable price. The cost of labor to assemble kits was shouldered by the person building the kit, with savings of 30 to 50 percent being realized over assemblies already built. Thanks to kit manufacturers, many a budget-minded hobbyist was able to acquire top-line equipment. Most companies offered kits ranging from small accessories requiring one to two hours assembly time to full-size, top-line equipment requiring several days to complete. Not only did you build the kit, but you also aligned and tested the item, ensuring complete performance. And, if the kit ever failed, the kit builder was the best person to troubleshoot and repair it. As off-shore manufacturing gained in popularity, many of the companies offering kits seemed to fade away.

In the past few years, several small companies have begun offering a limited line of kits, mostly low-power CW transceivers. This past summer, a major manufacturer of amateur radio equipment published its first kit catalog. T-KIT, a division of Ten-Tec, announced that it was going to offer a line of kits, based upon quality designs used in its pre-built line of popular trans-ceivers. As a sideline, the catalog notes that Ten-Tec's chairman was president of Electro-Voice, supplying parts to Heathkit, when they began offering kits in the late '40s.

A quick review of the Ten-Tec catalog reveals a variety of offerings, including a 6 meter transverter, a 2 meter FM transceiver, and several low-cost mini-kits. The catalog indicates that this is only a sample of what's to come.

Curious, I ordered a couple of mini-kits, an add-on BFO and an active antenna to sample the basic level of product and care that Ten-Tec was offering. Within three weeks I received a small box containing two large plastic *baggies* full of electronic parts. Each kit contained a 1-3/4" silk-screened glass-filled board, associated components (resistors, capacitors, etc.), and a small instruction manual. One thing was soon apparent about T-Kits: They're definitely no-frills, bare-bones kits.

Assembly

Both kits were complete with clearly-marked components. The high quality glass-filled boards with thick copper etch were a breeze to solder to. As with any small assembly, use caution—use a 35-watt or smaller soldering iron.

Assembly time is about 30 minutes, including reading the manual from cover to cover. The kit included parts, an X-ray view of the circuit board, a detailed assembly checklist, testing instructions, and manual. Definitely brief, but adequate, the manual does its job.

Testing/Performance

Snapping on a 9-volt battery to each kit and a slight alignment to the coil of the BFO yielded expected results. They work!

Active Antenna (P/N 1552): With the antenna-out connected to an AM/SW radio and a 13-inch whip attached to the antenna-in connection, foreign broadcast stations popped in as if I had attached an outside wire. Removing the battery while listening to an average-strength broadcast all but lost the station. Antenna gain is spec'd up to 20 dB, adjustable. It should be noted that the active antenna is an untuned broadband amplifier. Performance is excellent with whip antennas up to about 40 inches. If you want to use the 1552 Active Antenna as a preamp (often called a pre-selector) with your full-size outside antenna you will need to add a tuning circuit to the input and or output. Without a tuned input and/or output circuit, undesirable results will occur.

Universal 455 BFO (P/N 1050): The output frequency of the BFO is designed for 455 kHz, making it compatible for most general coverage shortwave radios. Connecting the output wire to the antenna connection of your radio generally will produce enough coupling to cause a beat note for copying stations transmitting in code (CW) and single sideband (SSB). If necessary, the manual suggests using a small coupling capacitor placed in series with the output and directly connected to the radio's intermediate frequency circuits. I didn't find occurrence where I needed to directly couple the BFO. In fact, on some less expensive radios, placing the BFO near the antenna or back of the radio produced enough coupling to work.

Once the on-board coil is set to provide a good strong injection signal, pitch (sideband selection) can be adjusted with the variable resistor. The 10k variable resistor is a little too coarse for my liking. I substituted a 1k and found the frequency spread easier to control.

Packaging

As stated earlier, these mini-kits are bare-bones offerings. This, in many ways, further stimulates the packaging engineering in all of us. Once completed, the PC boards can be installed in a radio (provided there's room), or out-board in a suitable enclosure. Ten-Tec offers several types of enclosures for the completed kits. Some include all necessary hardware, including knobs, switches etc., while others include only the case. I chose to use my junk box and fashioned a suitable case to house both the active antenna and the BFO.

"A quick review of the Ten-Tec catalog reveals a variety of offerings, including a 6 meter transverter, a 2 meter FM transceiver, and several low-cost mini-kits. The catalog indicates that this is only a sample of what's to come."

Final Thoughts

The yellow and brown thick manual familiar to Heathkit builders is not there. Nor, for that matter, is the quick short course in reading component values, coupled with a detailed narrative on circuit operation including voltage measurements throughout the circuit. (Of course these kits sell at a fraction of the cost of a Heathkit, so one probably wouldn't expect to see such a thick manual anyway.) What is there is a well-engineered circuit with high-quality PC board and components coupled with sufficient instructions to allow you to build an electronic circuit that works, and can be used as your imagination dictates. All this for about $10 a kit!

It was fun building the kits. I am currently planning to assemble several of the larger Ten-Tec kits and will let you know in a future article what they look like.

Keep the iron hot! RF

"Rig Here is Home-Brewed"

Thoughts on building a transmitter.

by Bill Meara N2CQR/HI8

My introduction to ham radio came via the nightly AM radio programs of that master storyteller Jean Sheperd K2ORS. My dad and I would sit in the kitchen and tune to New York's WOR—710 AM—and listen to "Shep's" tales from days-gone-by. Amidst the stories about his senior prom and catastrophic Fourth of July parties, Shep would from time to time talk about ham radio. Because of these programs, my first images of the hobby involved enthusiastic youngsters scouring parts shops in search of exotic components for use in the construction of mysterious shortwave radios.

With encouragement and help from Mom, Dad and the Crystal Radio Club (W2DMC), I soon became a licensed ham and got on the air. I suppose it can be said that I did some home-brewing—I built the power supply for a Heath monoband SSB rig from components salvaged from a TV set, but I never quite felt that I'd shared in the radio-building adventures of Jean Shepherd and his intrepid friends. I wanted to be one of those guys! I wanted to build my own radio!

As a teen-age ham I made a couple of attempts to join the "home-brew club," but I was denied this exalted status because of my poor metal-working skills (you had to be good with a chassis punch in those days) or because I bit off more than I could chew and tried to build things beyond my capabilities. When I returned to the airwaves two years ago, I found that my long-dormant yearning to "home-brew" *had* returned with a vengeance!

This time I decided to play it smart: I would start out slow with easy projects that seemed sure to work. I would look for circuits that I found easy to understand, and I would avoid anything that seemed to require skills or tools beyond my reach. I set as my goal the eventual construction of a transmitter that I could incorporate as part of my station—a transmitter that would enable me to say, "RIG HR IS HB!"

While there is a lot of debate about the place of Morse code in the modern era, CW does offer one undeniable advantage: extreme simplicity. For the beginning home-brewer, a Morse code transmitter offers the easiest avenue to success: Rigs just don't get any simpler! I was shooting for success via simplicity so—for me—CW was clearly the way to go.

QRP Projects

The QRP movement provided lots of schematics for easy-to-build rigs. I started out with a single transistor transmitter called the Michigan Mighty Mite (featured in the March 1992 issue of *CQ*). This rig is simplicity itself—the coil is wound on a discarded plastic film container. I put it together on a little piece of perf board. At first it didn't seem to work, but with my receiver tuned to the crystal frequency, I fidgeted with the components a bit until—Eureka!—it started to oscillate! I was generating RF! I felt like I was right up there with Maxwell, Hertz and Marconi! I wasn't able to make any contacts with this little rig, but my confidence level soared and I began to search for a more substantial transmitter project.

I found just what I was looking for in the ARRL publication *QRP Classics* (available from Uncle Wayne's Bookshelf). The 6-watt variable crystal oscillator (VXO) controlled CW transmitter circuit caught my eye because the circuit seemed to come right out of a basic radio theory textbook; there it was: oscillator, buffer, driver and power amplifiers—all discrete transistors, no mysterious "black box" ICs, no exotic experimental circuitry . . . here was a circuit that I could understand!

I was also attracted by the 5 or 6 watts of power out promised by the circuit—this seemed to be enough to guarantee some QSOs. The variable crystal oscillator seemed to provide the simplicity and stability of crystal control without all of the inconvenience of being "rock bound" on one frequency. The printed circuit board layout was very simple, with the components sufficiently spread out to allow for easy assembly. I decided to build the 20 meter version of this transmitter.

> ***"This time I decided to play it smart: I would start out slow with easy projects that seemed sure to work."***

From the electronic parts catalogs that had been accumulating in my shack I began to order the components. I supplemented this mail order effort with visits to Santo Domingo's secondhand parts stores. It was fun to plunge into the chaos of those stores and emerge with tiny components that would soon find their way into my transmitter!

Construction Hints

On this little rig, the two most difficult tasks in the construction were the printed circuit (PC) board fabrication and the winding of the coils.

While there might be a temptation to try to acquire a ready-made printed circuit board, if you are shooting for that warm glow of satisfaction that comes from having built it "all by myself," I suggest that you make your own board. (Would that be a Politically Correct PC board?). This is not as difficult as it might first seem—there is a lot of literature out there on how to make your own boards and there are many tools and kits available. Leave yourself some margin for error and be prepared to discard one or two of your first attempts. There are a lot of different ways to lay out the circuit pattern and to etch, clean and drill the holes in the board. As I went through the process I sort of developed my own favored technique. I wasn't quite happy with the first board I produced, so I made a second board that came out a lot better. The first board, while kind of ugly, later served as the base for a 30 meter version of the same transmitter.

Winding the toroidal coils seemed tricky at first but after consulting the literature for some guidance, I sat down with the cores and the wires and started winding! After a while it became kind of relaxing! I wound all the coils in one afternoon and added them to my now growing collection of components.

Having had a couple of bad experiences with electronic projects that didn't work, I decided to proceed carefully in the hope of avoiding the agony of troubleshooting. I checked all the components with my volt-ohmmeter before mounting them on the board. With a large wad of steel wool at hand, I made sure that the board surface and the component leads were clean and shiny before soldering. After soldering each joint, I made a continuity check with the VOM to make sure I hadn't created a cold solder joint.

The board filled with components very quickly and soon I was approaching the moment of truth! I didn't even wait to mount the PC board in a cabinet. With nervous fingers and with my receiver tuned optimistically to the transmitter's crystal frequency, I connected my key, dummy load and finally the battery to the spider-like creation that had taken so long to assemble. When I finally connected the red wire to the positive battery terminal, I was rewarded with a solid tone from the receiver. The joy of oscillation! I knew that at least one stage of the rig was working right off the bat. A few quick checks showed that the amplifiers were amplifying—I was now ready to challenge the ionosphere with 5 watts of continuous-wave RF!

The Results

I know that when most articles of this genre get to this point a fantastic claim is often made: "I then connected the milliwatter transmitter to a garbage can in my basement and worked Antarctica through the pile-up on the very first call!" Well, my home-brew success story is not quite so dramatic (or fantastic) but I did manage to work Poland on the first call from this little rig. It was quite satisfying to look at that little collection of parts, wire and solder and think that I had used it to bridge the mighty Atlantic.

After working Europe on the first try, I decided that this little rig definitely warranted a proper cabinet so I soon had it mounted in a little metal and plastic box that I'd acquired by mail order. Now it looked like a real radio. After a while I got tired of having to open up the cabinet to change the crystal, so I "designed" a little rotary switch arrangement that let me change crystals with the turn of a switch. I find this kind of little modification is very rewarding—the home-brewer has the opportunity to use his or her ingenuity in making improvements on a radio.

This little construction project was a big success for me. By the time I was finished I had some very useful and reliable new equipment to add to my station. The 30 meter version of this gave me my introduction to the WARC bands. As luck would have it, shortly after completing the 20 meter rig, my main transmitter (an old but much-loved HT-37) developed serious problems that put it off the air for a couple of months. Fortunately, with my home-brew transmitter and a Drake 2-B receiver I was able to stay on the air. Most important of course was the satisfaction that came from using a transmitter that I'd built with my own hands—I felt that I had finally earned a place among those intrepid lads who had stalked the parts stores, cannibalized old radios, filled their basements with solder smoke and got on the air with home-brew gear! "RIG HR IS HB!" FB! RF

Resistor Capacitor Oscillators

by Robert C. Green W3RZD

Even though audio frequencies extend up to 20 kHz there are radio stations operating on frequencies of 18 kHz and lower. The use of radio in the audio range may seem unusual, yet there are many shore-based maritime stations using these frequencies. This is because of the vast area of signal coverage afforded both day and night to ships at sea. There have even been newspaper reports that the United States Navy has been experimenting with even lower frequencies for communicating with submerged submarines.

While radio frequencies extend into the audible range they cannot be heard because they are electrical. Audio frequencies are physical waves and anything physical can be heard or detected by the human body.

Regardless of what frequency range is used, an oscillator is required to generate the signal. For low audio frequencies the oscillator can be mechanical or electrical. Mechanically, it could be a clapping of the hands or the slamming of a door, or even a doorbell, which is both electrical and mechanical. However, at the higher audio frequencies the oscillator is usually electrical. Any radio frequency always requires an electrical oscillator, and some types are better suited for certain frequencies than others. As an example, an oscillator using an inductor and capacitor is preferable at the higher radio frequencies, while a resistor capacitor type is better for audio and low radio frequencies.

An ordinary amplifier can be converted into an oscillator for audio or radio frequencies if three conditions are met: a portion of the amplifier's output voltage must be returned to the input; the returned voltage or signal must be routed through a filter that is tuned to the wanted frequency; and the returned voltage be in phase with the input signal. When the returned signal is in phase the circuit is said to be regenerative. Regeneration means there is a 360-degree loop for the signal to travel.

In each stage of a tube-type amplifier the signal will be inverted by 180 degrees, so to get the output in phase with the input there must be an even number of stages—that is, 2, 4, 6, etc.—but normally only two stages are used. Some transistor circuits will also invert the signal, and if a circuit of this type is used it will also be necessary to have an even number of stages. However, there is one type of oscillator that uses only one stage of inversion, with the additional 180 degrees of phase shift provided by an external circuit. This oscillator will be described further on.

Before going any further it might be wise to clear up any misconceptions that might occur between the terms "tuner" and "filter." Basically, the terms are interchangeable, and either can be made to reject or to pass a frequency. Normally the term tuner refers to a fixed and variable component, and the term filter means only fixed components are used. But there isn't any hard and fast rule to this.

Assuming the three conditions mentioned above are met, what actually starts the amplifier oscillating? When the amplifier is turned on, thermal agitation causes random low-level noise voltage to appear at the output of the amplifier. The noise covers a wide band of frequencies, including the wanted frequency. Before the noise dies out, part of it is passed to the input of the amplifier through an external circuit, and is amplified. Again part of the output is returned to the input to be amplified. The cycling continues until there are strong sustained oscillations at the desired frequency. The desired frequency is picked out of all the frequencies because the external circuit consists of a filter tuned to that frequency. At the same time the filter eliminates all other frequencies and shunts them to ground. Figure 1 shows one type of filter using an inductor and capacitor connected in parallel. A filter or tuner of this type shunts the unwanted frequencies to ground while rejecting the wanted frequency which is routed to the amplifier's input.

Normally an inductor and a capacitor can be used for tuning from the very high end of the audio range to several hundred megahertz. Above and below this range electrical and physical problems arise that prevent their use. At the high end it's due to the small electrical values needed and the associated small physical sizes, and at the lower end it's the very large electrical and physical sizes required. At lower frequencies the physical size of the capacitor can be a nuisance but usually it is the large physical size of the inductor that is the major problem. It is difficult to shield or isolate the coil from other components. To overcome this difficulty a different method of tuning is used, a method that uses resistors and fixed capacitors. This type of circuit is found in the "phase-shift" and "Wien-bridge" oscillators.

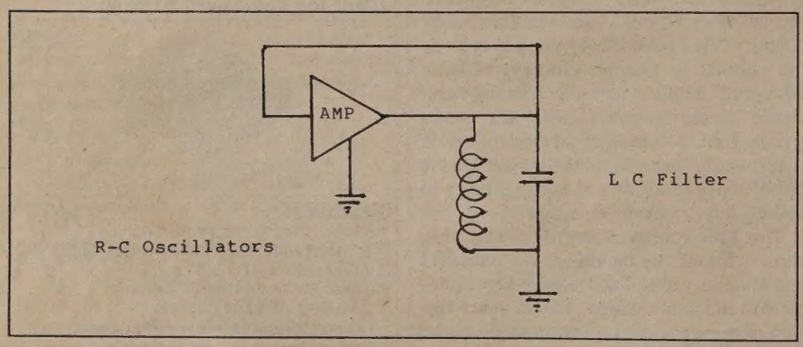

Figure 1. An LC filter, using an inductor and capacitor connected in parallel.

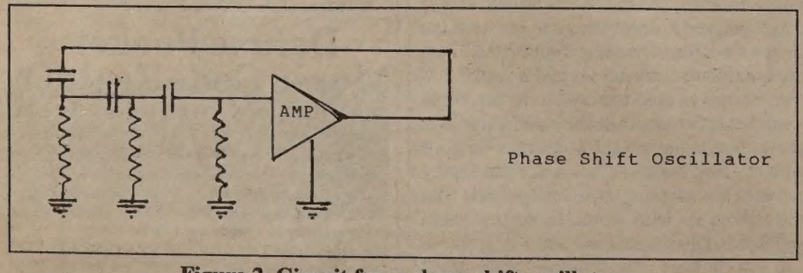

Figure 2. Circuit for a phase-shift oscillator.

Phase-Shift Oscillators

The basic circuit for the phase-shift oscillator is shown in Figure 2. The circuit is simple and very stable and is used quite extensively for fixed audio or low radio frequencies.

The theory of the phase-shift oscillator is as simple as the circuit itself. When a DC voltage is placed across a capacitor and resistor connected in series, as shown in Figure 3A, nothing happens. No current flows because the capacitor acts as an open circuit. But in actuality a minute current can flow if there is any leakage in the capacitor. If the DC voltage is replaced by an AC voltage of a fixed frequency a current flows due to the reactance (AC resistance) of the capacitor, and the current leads the voltage by a certain number of degrees. This is a phase shift, meaning the current and voltage are not in step or in phase with each other. (If an inductor had been used in place of a capacitor the current would be lagging the voltage.) The number of degrees of phase shift depends on the value of the capacitor and the frequency of the AC voltage. The current flowing in the resistor is due to the reactance and is also leading the voltage by the same number of degrees. The resistor does not alter or create any of the phase shift; it is only one-half of a voltage divider.

If the capacitor value remains fixed and the frequency is varied there will be one frequency at which the phase shift will be 60 degrees. When another capacitor and resistor network with the same values are connected to points Y and Z in Figure 3A, it will also have a 60-degree phase shift. There is now a 120-degree phase shift, so when a third network is added there will be a total shift of 180 degrees. See Figure 3B.

By using a single-stage tube or transistor amplifier that inverts the input by 180 degrees and adding the three-stage RC network, there will be a 360-degree phase shift at the one frequency. At this frequency the amplifier's output is in phase with the input. Thus the three-stage capacitor resistor network forms a frequency-sensitive feedback loop, and an oscillator is born.

There are losses in any RC network. The fewer the number of sections used in the total network results in a higher loss because each section has to shift the signal a greater number of degrees. To reduce the losses more sections can be added: four, five, or even six sections can be substituted for the normal three. But, the capacitor and resistor values have to be changed as additional sections are added. If four sections are to be used, each section must have a 45-degree phase shift (45 degrees x 4 = 180 degrees). The values will also be different for five sections, which equal 35 degrees per section. Six sections equals 30 degrees per section. Regardless of the number of sections used there must be a 180-degree phase shift. The number of sections needed is determined by the gain of the amplifier, but usually just three sections will do.

The phase-shift oscillator must also meet three requirements. One is that the amplifier have a high impedance input to prevent loading the RC network. The second is that the amplifier must have a gain of at least 29 to maintain oscillation. The final requirement is that in order to maintain a consistent sine-wave output, the amplifier must be operated with Class-A bias.

The frequency can be shifted over a wide range by changing the values of all the capacitors and resistors in the feedback network. If the values are decreased the frequency will increase, and if the values are increased the frequency will decrease. However, the frequency can be varied a small amount by replacing one of the fixed resistors with a variable resistor.

The Wien Bridge

In electrical terms the definition of the word bridge is "... an instrument for accurate measurement of electrical values." The Wien bridge is such an instrument. It was developed to measure capacitance to a high degree of accuracy, but today it probably sees more service as an oscillator.

A bridge consists of a combination of resistances, capacitors or inductors, with one being the unknown value to be measured. One of the other units is the "standard" to which the unknown is compared. The units are connected in the form of a loop, and a voltage is applied to two opposite points on the loop. A sensitive meter is connected to two other opposite points on the loop to indicate when the unknown's value is found. The value is then read from six small dials arranged in a decade fashion. Figure 4A shows the basic Wien bridge, with C2 as the unknown.

When the Wien bridge is used in conjunction with a two-stage amplifier in order to get a 360-degree phase shift, it becomes a very efficient oscillator. This is shown in Figure 4B. However, notice that the input and output points are reversed from the basic bridge. The two points that were

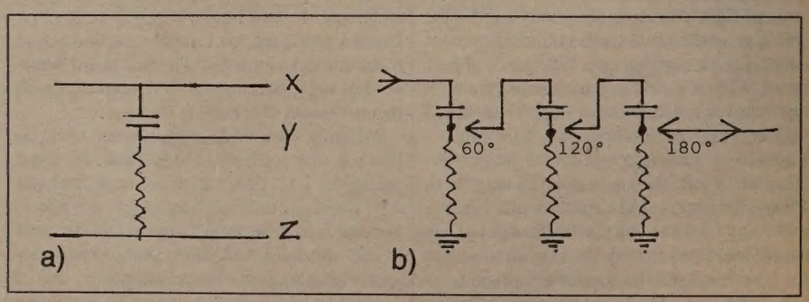

Figure 3. A) DC voltage placed across a capacitor and resistor connected in series. B) Phase shift.

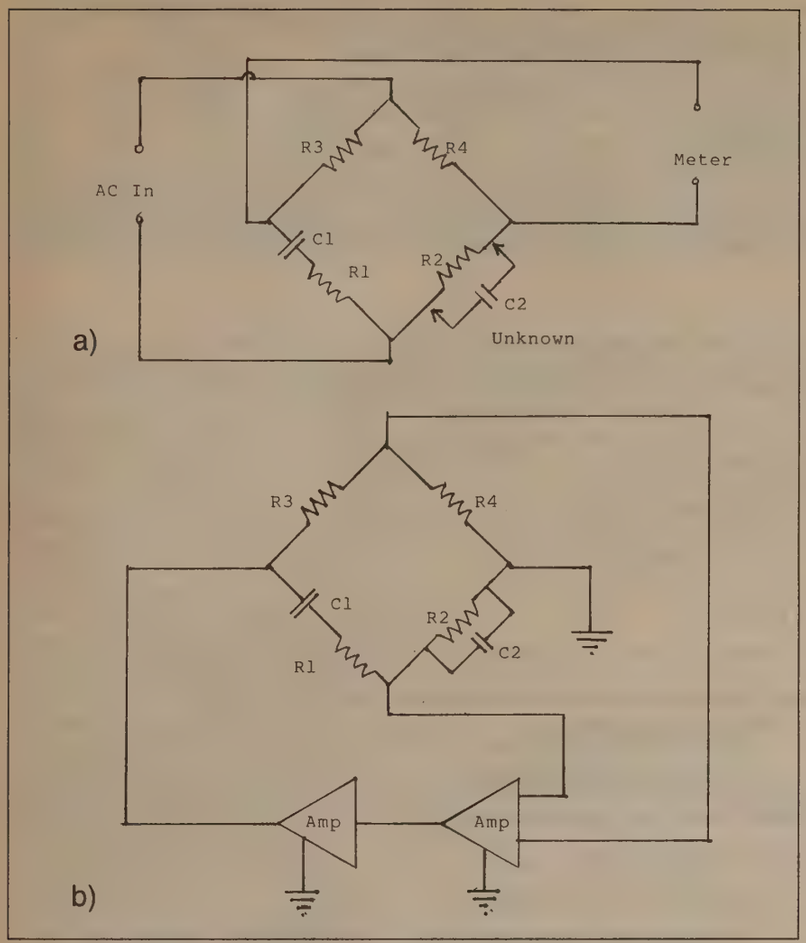

Figure 4. A) Basic Wien bridge. B) Wien-bridge oscillator.

connected to the meter now have the voltage that is fed back from the amplifier's output. Also, capacitor C2 is not an unknown value, but has the same value as C1. The four elements, C1, R1 and C2, R2, now form a frequency-sensitive network.

Resistors R3 and R4 form a voltage divider to control the bias of the amplifier to keep the output level constant. However, R4 is not a regular resistor but a voltage-sensitive resistor whose resistance changes with the amount of voltage applied. R4 can be a tungsten filament lamp, a thermistor or a varistor. Both the thermistor and varistor are solid-state devices. The lamp and the thermistor are temperature-sensitive and change resistance with the amount of heat generated within them by the voltage. The varistor will also change resistance as the voltage changes but is not heat dependent. All three devices are non-linear in operation and Ohm's Law does not apply.

Resistor R3 should have a value that is twice that of R4 when R4 has about one-half of the normal negative feedback voltage across it. This allows the resistance of R4 to vary around a center value. The feedback voltage from the junction of R3 and R4 is fed to the amplifier. On a tube amplifier this would be the cathode and on a transistor it would be the emitter. The negative feedback voltage should remain constant regardless of the frequency.

Because capacitors C1 and C2 are of equal value, as are R1 and R2, the combination becomes a voltage divider whose output changes with frequency because the reactance of the capacitors will vary with frequency. The entire network performs two jobs: proportioning the amount of negative feedback and passing one frequency more efficiently than other frequencies.

To see how this happens, assume that a fixed frequency oscillator of 5 kHz is wanted, and also assume that the values of C1 and C2 have been figured mathematically to have a minimum reactance at 5 kHz. Also, assume that the bridge is connected between the output and input of a two-stage amplifier.

At any frequency below 5 kHz the reactance of C1 is larger than what it will be at 5 kHz. The reactance adds to the resistance of R1 and reduces the voltage at the junction of R1 and R2. This in turn reduces the voltage to the input of the amplifier. At frequencies above 5 kHz the reactance of C2 will be large, and being in parallel with R2 reduces their combined value. Ohm's Law states that when resistance or reactance are in parallel the result is always less than the smallest value. So now most of the input voltage goes through the low resistance to ground. However, at 5 kHz the reactance of both C1 and C2 are at a minimum, which puts a higher voltage at the junction of R1,R2. The signal through the amplifier and back to the network is now 5 kHz, and other frequencies are eliminated.

The Wien bridge can be modified by replacing R3 and R4 with a tube or transistor stage. A portion of the amplifier's output voltage is rectified by a diode that is connected backwards, resulting in a negative output voltage. The negative voltage is then fed into the bias stage which operates as a variable resistor.

It is fairly easy to make the Wien bridge into a variable-frequency oscillator, so the circuit is found in generators for audio and low radio frequencies. Most generators of this type cover a range of 10 Hz to 100 kHz, divided into four bands. On the front panel there is normally a frequency scale calibrated from 10 to 100. The scale has a 1 to 10 ratio, and using this ratio the bands will be 10 Hz to 100 Hz, 100 Hz to 1 kHz, 1 kHz to 10 kHz, and 10 kHz to 100 kHz.

R1 is replaced by a bank of four switched resistors, as is R2. Since each band has a 1 to 10 ratio, the resistor values in each bank will have the same ratio. An example of this might be 40 megohms for the lowest band, 4 megohms for the next, 400 K for the third and 40 K for the highest band. Capacitors C1 and C2 are replaced by a two-section ganged variable capacitor, with both sections having the same capacity. One section is for C1 and the other for C2. When the bands are changed only the resistors in each bank are switched, not the variable capacitor. In the better grades of commercially-made generators, both R3 and R4 are replaced by a bias-stage amplifier. A tungsten lamp, thermistor or varistor may be found in older models and home-built kits. RF

Ground Fault Circuit Interrupter

This box is a lifesaver!

by Herbert M. Rosenthal WV5Q

Scenario

Plug an electric drill into a frayed extension cord to work on your tower, or use a soldering iron at your garage workbench (concrete floor), and your life may virtually hang on chance! Chance that insulation has failed, chance that the "double insulation" drill is no longer insulated, chance that the soldering iron shell is "hot." You may become part of a circuit between the hot side of the 120 AC line and ground. Shock likely, electrocution possible!

Cost

For about $20-$25 you can greatly reduce the hazard of an improperly grounded work setup . . . whether on the tower, in the yard, or on a concrete floor. It's a shame to spend a zillion bucks on a tower, beam, and rig, only to zap yourself at 60 hertz, when you could be on 20 CW.

Prevention

The Lifesaver box contains a GFCI receptacle—that's a Ground Fault Circuit Interrupter, which costs about $8. It has two polarized receptacles with U-ground holes, *reset* and *test* buttons.

The GFCI receptacle is designed to interrupt current to the receptacle if there is current from the high side to ground, *not* through the receptacle's neutral. This path could be through you, to the grounded tower, concrete floor or earth.

If the high side (narrow slot) has 5 mA or more current than the neutral side (wide slot), *current must be returning to ground through some other (undesirable) path . . .* perhaps your hands, chest, heart, etc. The built-in contactor is design-ed to open in 1/30th of a second, cut-ting off current to the receptacle, and possibly saving your life.

Construction

The hardware store items required are listed in the Parts List.

The Bell box has three holes threaded for 1/2" conduit; two plugs are supplied to fill unoccupied holes. Coat the threads with RTV or similar goop, then screw the Romex connector into one end of the box, and the plugs into the bottom and opposite end.

Read the instructions for your GFCI receptacle. Pass the cord through the Romex clamp. Twist and tin about 3/4" of each stranded lead so it does not fray when tightened under the GFCI screw terminal. You must wrap these *clockwise* under each screw head. The black wire goes to the hot line terminal, the white wire goes to the neutral line terminal, and the green wire goes to the green screw on the GFCI mounting strap.

Use your meter to verify continuity: wide blade of the plug is neutral (white), narrow is high (black), and the U-ground wire is green. The two GFCI terminals labeled LOAD are not used in this application; they are used to protect additional receptacles in permanent wiring. After the receptacle is wired, mount it and the cover. Wind a few turns of tape around the cord, push it into the cable clamp, and tighten it. Waterproof the cable clamp with RTV or silicon caulking.

Testing

Testing is simple. First, plug the cord into a properly grounded receptacle. On an old wall receptacle with no U-ground, use a grounding adapter connected to the center screw of the receptacle. Then plug a lamp into your new box, turn its switch on, press the GFCI "reset" button and the lamp should light. Press the "test" button next, and you should hear a click, and the lamp should go out, verifying a good GFCI.

Press the "reset" and the lamp should light. If all this doesn't happen, re-read the GFCI instructions. You may have a permanent wiring error in the wall receptacle (leads reversed, box not grounded); heed the GFCI written warning. *Unless this wall receptacle is wired and grounded properly, you have no protection from GFCI.* Remove power to the wall receptacle if you remove its cover plate for any reason.

Never, never use old, unpolarized extension cords—the ones with two wires (no U ground), and with both plug blades and receptacle slots the same width—either before or after the box; this will negate the inherent safety of the GFCI.

"For about $20-$25 you can greatly reduce the hazard of an improperly grounded work setup . . . whether on the tower, in the yard, or on a concrete floor."

Epilogue

That's it. Use it *all the time*. Remember, if the GFCI trips, and it will not stay reset, you have an unsafe work setup . . . a potentially lethal one. You may have saved your life for 20 bucks!

Test the GFCI box periodically with the *test* and *reset* buttons; GFCI receptacles do go bad. RF

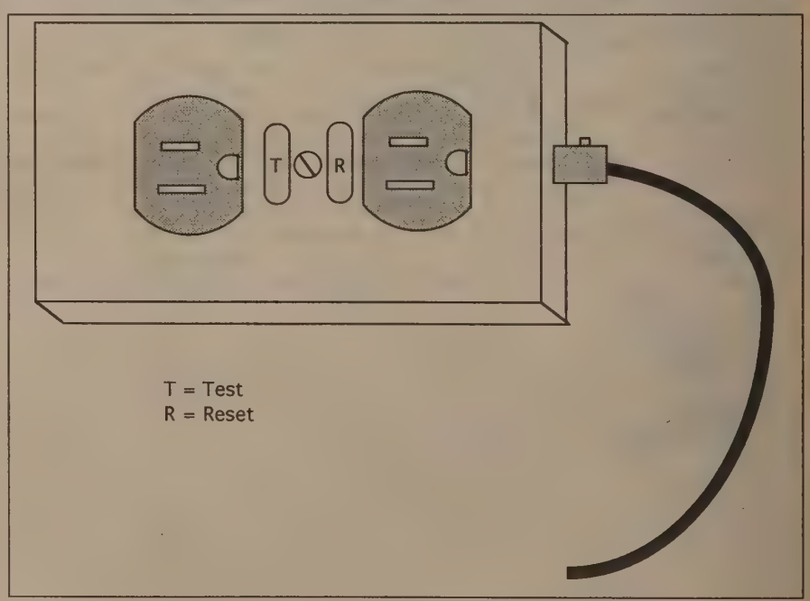

Figure 1. The GFCI mounted in a water resistant Bell box.

Parts List

1	GFCI receptacle rated 15 amps
1	Single-gang raintight receptacle box (a "Bell" box)
1	Rainproof GFCI cover
1	6-foot, #16-2/with ground replacement power cord with U-ground, polarized plug molded to cord
1	NM cable clamp (ROMEX connector) electrician's plastic tape

RF user report

NCG/Comet
1275 North Grove Street
Anaheim CA 92806
Telephone: (714) 630-4541;
Fax (714) 630-7024
Price Class: $179;
optional 20 meter coil $29.

The Comet HA4S Mobile HF Antenna

by Arnie Johnson N1BAC

While reviewing an HF transceiver for *73* recently, I realized that I could take the transceiver out on the road for a "test drive," but alas, I had no mobile HF antenna. I remembered that the cover of *73*'s September 1994 "Special Antenna Issue" had a nice picture of a car with a mobile HF antenna on it. It looked so different, I had to give it a try!

Within several weeks I received a phone call to "come and get it." "It" was the Comet HA4S Quad Band Mobile Antenna for 7, 21, 24, and 28 MHz, with the optional 14 MHz coil included in the package. The package was a 3' tube, 3" in diameter. Inside were five coils and the base unit inside plastic protective sleeves, instructions, a wrench, and an Allen wrench.

It was very simple to install the coils in the coil mount bracket. The 7 MHz coil was installed in the vertical position on the bracket with the 14, 21, and 28 MHz coils screwed into the lower mounting holes. Each coil has a coil fix lock nut on the thread which is then tightened against the bracket to hold the coil. The whole antenna was then screwed into the SO-239 mount on my minivan. Is that simple or what?

The next step was to tune each coil individually by using the supplied Allen wrench to loosen the element fix screw of each coil and adjust the length of each element, longer or shorter, to find the best SWR point. Install an SWR meter between the transceiver and the antenna. Use as low a power setting as possible from the transceiver to avoid initial high SWR from damaging the transceiver. To lower the frequency point of the coil, lengthen the element; to raise the frequency point, shorten the element, then tighten the set screw again. Comet says that a 1 cm adjustment will cause the following frequency shifts on each band: 7 MHz = 0.042 MHz; 21 MHz = 0.26 MHz; 24 MHz = 0.33 MHz; 28 MHz = 0.36 MHz. For example, if the lowest SWR frequency is 7.09 MHz and your desired center frequency is 7.2 MHz, shorten the element by 7.20 minus 7.09 divided by 0.042 = 2.619 cm. Now, that's precise!

Performance

After adjusting the SWR on each band, I started tuning around on my trusty Atlas 210X looking for a QSO. Unfortunately, the 21 and 28 MHz bands didn't work as well as I wished; actually, they were horrible. However, 7 and 14 MHz did provide some good QSOs. Actual reports were probably what would be expected of a mobile antenna, certainly respectable. I was hearing a lot more than I was able to get back to. Part of that problem was that I had to run lower output power on 14 MHz because every time I transmitted at full power, my windshield wipers would start working, and it wasn't even raining!

Several more things should be mentioned. First, the instructions state that the HA4S is designed to use the car body for its ground radials. It requires complete grounding between the antenna and the car body to get a good SWR. I decided to mount the antenna in a magnetic mount that I had available and found that the instructions were correct: I was able to make QSOs but with a much higher SWR and worse results. Second, the antenna does have a very nice feature: the ability to fold down, such as when driving your car into a garage. All you have to do is to twist the sleeve by hand, pull the sleeve up, and fold the antenna over. But, Comet notes that you should not drive the car while the antenna is folded down. It makes good sense because the antenna and coils are not supported in that position and could become damaged. Lastly, as with all other HF mobile antennas, the 2:1 SWR bandwidth is pretty narrow, especially on the lower frequencies. Remember that mobile HF antennas are great compromises from their quarter- or half-wavelength brothers and sisters; they work but with limits. Maximum power is limited to 120 watts SSB on 7, 14, 21 and 24 MHz and 200 watts SSB on 28 MHz.

What were my overall observations and impressions? This is another review item that I hate to give back! If you are looking for a multiband mobile HF antenna and don't like tall mobile antennas that "clank" against every overpass you go under or have to change coils or coil settings every time you want to change bands, then the Comet HA4S is definitely a good possibility for you: 4-1/2 feet (1.33m) tall with the 7 MHz coil on the top, and four bands. Even when it is mounted in the center of my minivan roof, it won't hit underpasses. But, don't forget to remove it before entering parking garages or going under low tree limbs, it doesn't have a spring base.

If you see a minivan with an HA4S and its windshield wipers going on a beautiful sunny day, it's probably me trying to make that mobile HF QSO. 73 and happy mobiling! RF

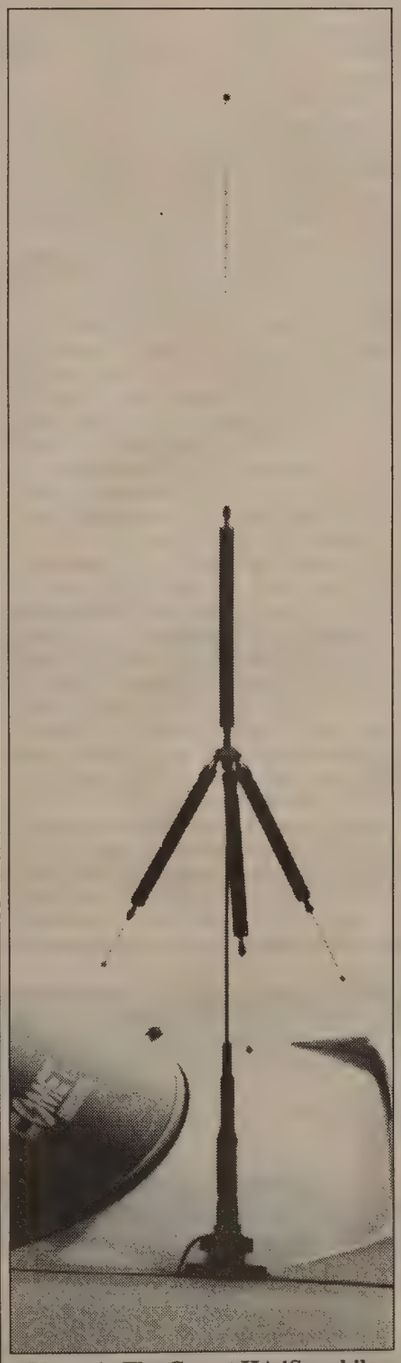

Photo A. The Comet HA4S mobile HF antenna.

RF review

S & S Engineering
14102 Brown Rd.
Smithsburg MD 21783
Telephone: (301) 416-0661
Price Class: Kit (without the keyer) $199.95;
see text for options

S&S Engineering's ARK 4 Synthesized QRP Transceiver Kit

by Jeff M. Gold AC4HF and Nils R. Bull Young WB8IJN

Many hams dream of a complete, high quality ham station that almost fits in a pocket and runs on easily available power. Hams are always looking for something different, something new and improved. And by the way, where is digital technology in ham kits? In many ways, the ARK 4 transceiver kit from S & S Engineering answers that dream.

The ARK 4 is a completely self-contained 40 meter CW transceiver. The receiver is a super-het single-signal design. The transmitter is synthesized using a PLL design. It has a sine wave sidetone and immediate recovery AGC. The fine-tune is crystal-controlled with a center detent. The RIT tunes +/-500 Hz. The case is steel and extruded aluminum with silk-screened front and rear panels. The transceiver weighs a mere 25 ounces and measures 5.5" x 1.5" x 7.5" (very nice and small). It runs on 12 to 14 volts DC and draws slightly more than 1 ampere on transmit for 5 watts output. All components, including the keyer, are on a single 5.26" x 7.18" double-sided circuit board.

An interesting feature for the ham whose budget overrides gut responses is the ability to purchase the rig by sections. The transmitter and frequency synthesizer circuits can be built and tuned up first and sell for $99.95. The receiver is a $49.95 add on, RIT and fine tuning costs $6.95, the audio filter is $9.95 and keyer options, based on the lastest Curtis Keyer chip is $39.95. The case option is $39.95, or you can get the entire kit without the keyer for $199.95. The kit was designed to be built in stages, which allows you many options. You can build sections as your budget permits or build only the parts you want. The kit goes together in sections even if you buy the complete kit. I really liked this approach. I prefer to be able to build a small section and test it before going on to the next section. This makes it much easier to correct a mistake if you make one.

Design

The ARK4 is a combination of state-of-the-art and common sense design. Frequency synthesis is built around the Harris 74HCT4059 programmable divider and 74HCT40 six-phase detector/VCO ICs. A set of push-button activated switches, similar to those used on military aircraft radios, selects the 100s and 10s values of the transmitter frequency. A single slide switch shifts the frequency between 7.0 an 7.1 MHz. The fine-tune and RIT options operate as VCXOs in the 9 MHz translation oscillator. The VCO and translation oscillator signals are combined and filtered to give an injection signal between 10.57975 and 10.72975 MHz. On transmit this 10 MHz signal is mixed with the transmit oscillator on 3.57975 MHz to produce a transmit signal within the first 150 kHz of the 40 meter band.

On receive, signals between 7.0 and 7.150 are mixed with the 10 MHz injection signal to produce an IF signal on 3.57975. This signal is filtered by a four-pole crystal filter and amplified by an MC1350, which in turn receives a fast-attack, fast-decay AGC signal from two sections of an LM324 quad op amp. This IF signal then goes to an MC3361 product detector. The final audio signal is amplified to drive headphones by one of the remaining two op amp sections of the LM324. The remaining op amp section serves as a side-tone oscillator on transmit.

All but one of the mixers in the ARK 4 use diode rings, and there is sufficient filtering to keep out-of-band oscillator and mixer products from appearing at the transmitter output. The receiver IF bandwidth is rated at 600 Hz by the manufacturer. Testing by comparing signals to a 500 Hz filter in the Drake TR7 showed that this specification is not off the mark. The audio filter option reduces the bandwidth to 400 Hz, centered around 600 Hz. The 600 Hz center of the AF filter latches the side-tone.

While the ARK 4 meets all the specifications that S & S Engineering claims, it is not without faults. Two of these seem related to the two sections of the LM324 quad op amp not used in the AGC line. The sidetone oscillator runs constantly and, despite this signal being shunted to ground on receive, there is some sidetone feedthrough into the receive signal. This feedthrough beats against received signals and adds a certain harshness to the audio. In fact, it is possible to tune the receiver so that the incoming signals zero-beat against the sidetone signal that sneaks into the audio amp.

The rig comes with a bound, 60+-page manual that covers almost every detail of construction and alignment. In addition to parts layouts (two copies, one to keep in the binding and another to help you as you build), the manual includes foil patterns for both sides of the plated-through board and a section on troubleshooting and theory of operations. Dick Szakonyi KA3ZOW, who designed and sells the kit, has also included an admonition to the doubting that says "Remember that your most effective troubleshooting tool lies between your ears. You can do it!" The most likely mistake would be to put a part in the wrong place on the board, or not to have a good solder joint. Of course, it helps greatly that the instructions are written in straightforward language, and are easy to follow. If all else goes wrong, the kit has one of the best guarantees in the business. If after building the kit you can't get it to work you send it back to S & S and if it is their fault they will fix it for free; if it is your fault they will fix if for $24.99. They also strive for a very rapid turnaround time on repairs, trying to fix it and send it out the next day. You just can't beat that.

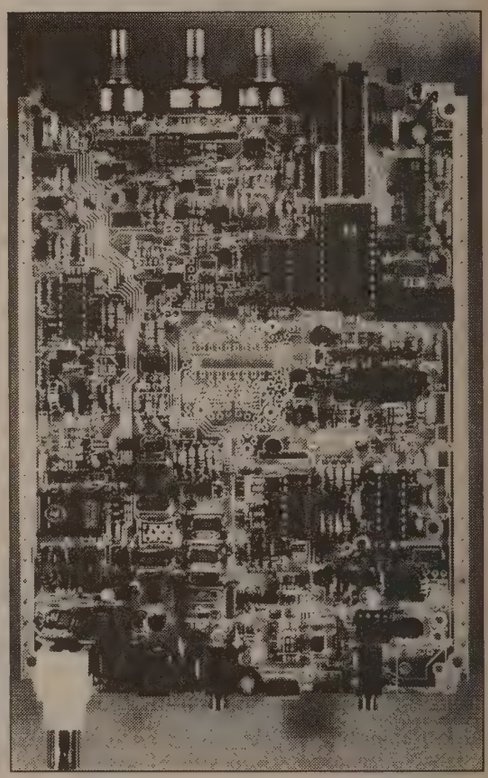

Photo B. The assembled board (without the keyer).

Assembly

Mounting and soldering all the parts on the board was a delight. The printed circuit board is of top quality and the silk-screening is very clear. Each section of the rig (transmitter and synthesizer, receiver and options) comes in its own bag of collected parts. This really cuts down time in separating out parts and makes this a very relaxing and enjoyable project. All important and easily confused parts are clearly labeled and packaged in their own plastic wrapping. All coils come prewound to help the kit go together quicker and with fewer hassles. The board is plated through and seems to suck up the solder. This makes soldering a lot easier and makes for much sturdier solder joints. You should take care in making sure a part is in the correct place before soldering and carefully watch parts that need to be placed in a certain direction. Although this type of board is easier to solder on, it is harder to desolder. As the ARK 4 goes together, it becomes increasingly obvious that MIL-SPEC quality was part of the design. One of the best features is the single board design. All the controls mount directly on the board. When you are done placing the parts, you are done soldering. Most kits require many wires to be connected between the controls and the printed circuit boards. It is hard to be patient after spending a good amount of energy and time on building the printed circuit boards and still having a lot of wire connections to complete.

Applying power to a kit upon completion is always a moment of doubt. But this radio seemed to spring to life, pre-tuned and ready for the first contact. This is another very unusual phenomenon. A few adjustments to reference and carrier or BFO oscillators, again guided by the clearly printed and well-written manual, and the rig was set to go. Tuning is accomplished with push-button switches. They're like thumbwheel switches, but you push a button to increment or decrement the frequency. The fine-tune control will tune +/-500 Hz and is a normal analog control.

Both authors communicated via electronic mail

Photo A. The ARK 4.

over the Internet about progress building the rig. We decided the best test of the rig was an ARK 4-to-ARK 4 QSO. We both were very surpised and pleased at how stable the rig is and how good it sounded on the air. We found the receiver to be very sensitive and selective. It is nice to know that if you plan on meeting someone at 7.045 you will be right on frequency. The RIT and audio filter work very well. I find I operate the rig with the audio filter in the narrow position. We both have received excellent signal reports while testing.

A small audio problem is a high-pitch whine that is audible with the AF gain control turned full counter-clockwise. This signal is not noticable on my rig at any usable level, even at the point where you can hear a very weak signal. There is also a birdie at 7.0453, and its existence is noted in the manual addenda. Solid-state QSK purists may be further annoyed by noise from the relay used to shift the antenna and to key the output stage of the transmitter. This bothered me a little when I had an external amplified speaker hooked up, but is not very noticable with headphones. The rig was designed to be used with headphones so this shouldn't be a problem.

All in all, however, the ARK 4 is a perfect backpacking or hiking radio. Its size is perfect for the glove-compartment or the trail pack and its miserly power requirements make it a first-rate contender for the answer to the dream of a complete station-in-a-box. The technology behind the rig is backed up with a quality implementation. Once you get used to the push-button frequency selection, tuning is easy. Of course, QSK operation at QRP is a pleasure that must be experienced to be appreciated. The ARK 4 is as sensitive as many big rigs and it makes contacts. You couldn't ask more of a box this compact and filled with up-to-date technical features. RF

Specifications

Tuning range	7.000-7.1500
Tuning steps	1 kHz synthesized +/-500 Hz minimum fine-tune
Mode	CW
Sensitivity	0.3 uV (10 dB (s+N/N)
Output power	3-4 watts (12V supply)
Current Consumption	0.15 A max. receive 1.1 A Max. Transmit
Voltage range	11-15 VDC

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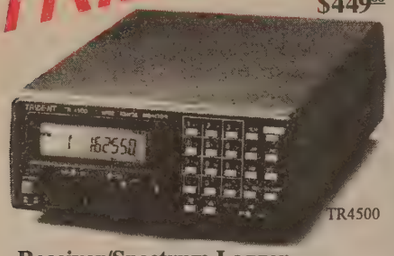

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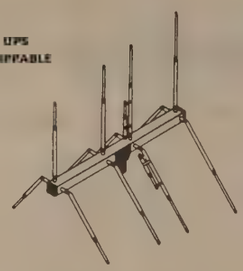

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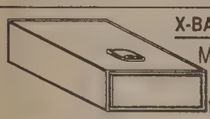

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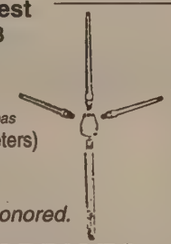

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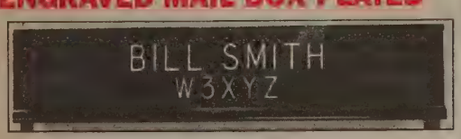

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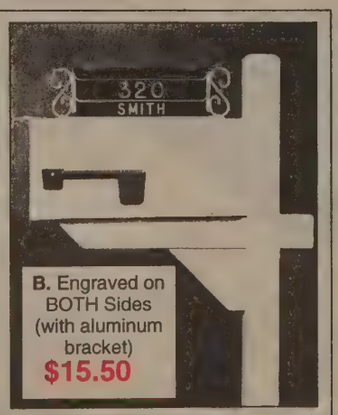

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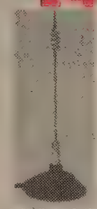

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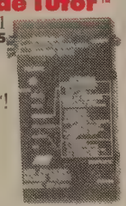

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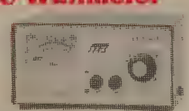

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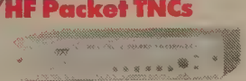

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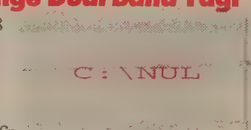

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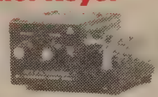

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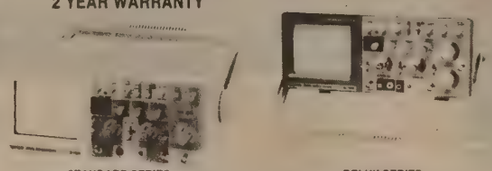

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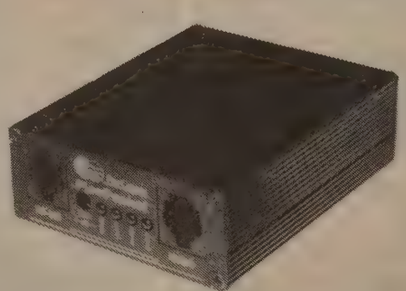

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RF vintage review

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Kenwood TR-2500 Handheld

by Oscar Staudt WB5GCX

I have been using hand-held 2 meter transceivers since 1976. I started out with a Wilson 1405, went to the smaller Wilson MK II, and then saw the advertisement for that "do everything" Yaesu FT-207R. I had to have one!

A few months ago, I saw an advertisement for the Kenwood TR-2500. There was that old feeling again—I had to have one!

When this new radio finally arrived, the first thing I noticed was its size. It feels like it was made to be carried around. I haven't actually put it next to an Icom IC-2A yet, but that is the size range it is in.

Photo A. The Kenwood TR-2500 handheld.

Memory Backup

The lithium-battery memory backup is a pleasant change. No more programming the memories every time I turn it on. Speaking of batteries, the TR-2500 runs quite a long while on a battery charge. Although it's only a 400 mAh pack, the radio is fairly easy on it. I've found myself adopting new battery habits, too. The Kenwood starts flashing its transmit LED when the battery is about depleted (it flashes in the receive mode, too). It's nice to have a few minutes warning before the radio is completely dead. Several minutes is plenty of time to say "73" or to grab a charged battery pack. Now, I just run my battery all the way down and then take the five seconds to slip on a fresh pack; you don't even have to turn the radio off! I suspect the NiCds will have a longer life if they are fully cycled.

The TR-2500 program features are super! I don't have to scan all of the band—only the part I am interested in. The audible beeps that sound when a function key is hit are also quite helpful. The auto-resume for scanning is a "have to have" item, and with the 10-channel memory I can store all the frequencies I need. This little radio just about does it all.

The one thing I might have wanted in the TR-2500 was extended frequency coverage for MARS. I mentioned this in the comments section of the buyer questionnaire included with the radio. I was quite impressed when I received an envelope from Trio-Kenwood a week later. It contained a simple modification to allow the TR-2500 to operate in the 141.000- to 150.995-MHz range. Now, that is being responsive to the consumer! A copy of the modification instructions is shown in the sidebar with this review.

The excellent engineering that was put into the TR-2500 is extended also to the optional accessories. The speaker/microphone is sturdy as well as very functional. The clip on the back has already proven useful while working on a local repeater antenna project. I could talk with just a push by my collar, and listen hands-free.

Accessories

The mobile stand is a very attractive accessory, providing both power and battery charging. You can also charge a spare battery. Another example of fine human engineering is the mobile stand's small light that illuminates the radio keyboard; it's even tinted green to match most auto dash lights.

The base stand is equally well thought out. Besides power for the radio, it also provides a fast (one to one-and-a-half hour) charge for batteries. The battery pack has a built-in heat-sensing device that triggers at 40 degrees C. According to Kenwood, this happens when the battery is at a 90% charge. The base stand then automatically switches to a trickle charge rate. If one only wants to trickle charge, this can be accomplished by turning on the charge switch before turning on the power switch.

Kenwood provides threaded holes in the radio case for the belt clip, a wrist strap, and a rubber earphone-jack protector. There are, of course, extra battery packs available, and even an empty battery case for throw-away alkaline batteries.

Just to be fair, I need to list my negative findings: The case doesn't impress me as being as sturdy as those of the FT-207R and the previous Wilson radios. The squelch sounds a little "soft." The speaker doesn't sound quite as good as the Yaesu, probably because it's smaller. I adapted rather quickly to the differences, though, and now don't even notice them.

Multi-Purpose Radio

This Kenwood TR-2500 is the only 2 meter radio I own. At work, I can set it on my desk and listen quietly to what is going on. In the car, I hook up to the outside antenna, with a 25-watt amplifier between, and it works beautifully. At home, I only need to hook to the outside antenna if I'm trying to hit one of the "far-away" machines.

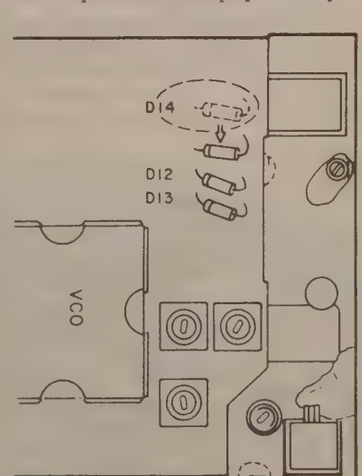
If any of you out there in radio land have been toying with the idea of trading up to a hand-held radio or getting a first one, I would strongly recommend taking a look at this Kenwood. It's just as capable as its larger counterparts. Try one—you'll like it! RF

Reprinted from 73 Magazine, June, 1982.

TR-2500 MARS Conversion

The TR-2500 is supplied to operate between 143.000 and 148.995 MHz. Frequency coverage may be expanded to 141.000 to 150.995 MHz.

1. Slide off the battery pack.
2. Remove three small Phillips head screws from the rear cover.
3. Remove four counter-sunk Phillips screws from the case bottom.
4. Remove the rear case; remove the PTT lever and set aside.
5. Desolder the backup battery top (negative) lead.
6. Remove four small countersunk Phillips head screws, two on each side, securing top to bottom frame halves.
7. Remove two small Phillips screws from the top panel. Use a flat blade screwdriver to pry up the panel. All four knobs will lift with the panel, as well as the black Offset mask.
8. Swing the front away to the right and unplug the speaker and mike lead from the RX TX unit. Do not over-extend the flex circuits.
9. Remove the felt insulation sheet from the PLL rear.
10. Carefully desolder D14. Use a low-power, fine-tipped iron and wick material, or a vacuum desoldering machine. Do not pull out the through-hole material, burn the PCB, or overheat and lift the foil. Clear the adjacent empty holes and move D14 to this new location. Solder sparingly and do not create a solder bridge.
11. Replace the felt insulation on the PLL unit.
12. Reinstall the PLL assembly. When reassembling, be sure to replace the black Offset switch mask under the top panel.
13. Reverse steps eight through one to reassemble. When resoldering the backup battery (step five), be sure not to short the battery to the chassis or adjacent shielded compartment.
14. The TR-2500 will now operate anywhere between 141.000 and 150.995 MHz, with any split. Please be sure you are authorized to operate out-of-band before transmitting. The display will show a small zero at 151 MHz in the MHz position. All other frequencies will display normally.



TR-2500 MARS conversion (top view).

RF vintage review

ICOM America, Inc.
2380 116th Ave. N.E.
Bellevue WA 98004
Telephone: (206) 454-7619

The ICOM IC-730 HF Transceiver

by Paul Grupp KA1LR

The ICOM IC-730 HF transceiver is the product of an engineering philosophy dedicated to offering as much radio in as small a package at as low a price as is feasible. ICOM currently offers two HF transceivers (the other is the IC-720A), but the design concepts behind the IC-730 more closely resemble the no-longer available IC-701 than they do the IC-720A. Because of this, we'll be comparing the IC-730 primarily to the IC-701.

Sitting flat on a table, the IC-730 measures just over 4" tall, 9-1/2" wide, and 10-3/4" deep, making it considerably smaller than either the IC-701 or the IC-720A. In addition to its unique features, it offers the usual amenities we have come to take for granted in an HF transceiver: RIT, RF gain control, digital readout, speech processor, VOX, fast/slow AGC, noise blanker (with two widths), IF shift, and a full 100 watts output (minimum) from the same finals that were used in the IC-701. No tune-up peaking or tweaking is necessary in either transmit or receive mode. On the bandswitch, AM is present along with SSB, CW, and a narrow CW position. The front panel is well laid out, a factor of great importance to both the dedicated DX-hound and the mobile operator.

Special Features

Like the IC-701, the 730 sports fully-synthesized tuning. Three interlocking push-button switches to the right of the main tuning knob select the tuning rate, which can be in 1-kHz, 100-Hz, or even 10-Hz steps. While some prefer continuous tuning, we feel that the many advantages of step tuning far outweigh any of the supposed disadvantages. The 10-Hz-per-step tuning makes for a positively luxurious bandspread—one complete revolution of the tuning knob changes frequency by only one kHz! When speed is of the essence, selecting the 1-kHz-per-step rate will allow you to get from the low end of the CW band to the high end of phone in two seconds flat.

Just beneath the tuning rate switches is the LOCK switch, which electronically locks the 730 on the displayed frequency. Engage it and the main tuning knob is disabled. If you've ever bumped the VFO knob just as a rare DX station returns your call, you'll appreciate this feature! The RIT control operates even when the LOCK is on.

ICOM transceivers are famous for their dual VFOs, so there are no surprises here. The IC-730 has two VFOs controlled by a four-bit microprocessor. They can be used separately as memories, keeping track of activity on two different frequencies, or they can be used together for split RX/TX operation. When you consider how much you normally pay for an external VFO, you begin to realize how much of a bargain the IC-730 really is!

There is also a separate memory for each band which can be programmed independently of either VFO. We've used virtually every HF rig which incorporates memory functions, and the IC-730 is the first unit we've seen which forced us to get out the manual to help figure out memory function. Fortunately, once you read through the examples, all becomes clear. Perhaps rewording the front-panel labels would speed comprehension! If you often operate on specific frequencies, you'll appreciate the memory backup feature. As long as there is 12V at the memory backup connection, the memories are not lost when power is shut off.

As is becoming common these days, metering is sparse. The IC-701 allowed you to view S-units, ALC, compression, collector current, voltage, and RF output. With the IC-730, you'll have to make do with ALC and RF output.

An extremely welcome innovation is the built-in preamp. While this may appear to be a gimmick, anyone who has used a good preamp can attest to its usefulness. The preamp is located between the low-pass filters and band-pass filters and, when switched in, exhibits about 12 dB of gain.

The IC-730 covers all ham bands between 80 and 10 meters, with generous amounts of coverage above and below each band. Our sample tuned everything between 3.4 and 4.01 MHz, 6.9 and 7.6 MHz, 9.9 and 10.6 MHz, 13.9 and 14.6 MHz, 17.9 and 18.6 MHz, 20.9 and 21.6 MHz, 24.4 and 25.1 MHz, and 27.9 and 30.1 MHz. The 10 meter band has four separate sections on the bandswitch.

The microphone connector is an eight-pin affair with pins to allow up and down scanning with a push-button microphone. Much to our surprise, the wiring diagram in the manual includes only the pinouts for PTT and audio. ICOM apparently feels that hams cannot be trusted to wire their own scanning microphones! The scanning capabilities are convenient for hams who wish to remote-control the rig for some reason, and it's a shame that ICOM didn't come right out and tell us which pin does what. If you intend to use these pins, make sure you know exactly what's what. Short the wrong pins and you'll watch blue smoke curling into the air!

Several controls are hidden away beneath a small port on top of the rig. Theoretically, these are controls which seldom need adjustment. There are pots for sidetone audio level, anti-VOX, VOX gain, VOX delay, frequency calibration, and SWR set. There are miniature slide switches for noise blanker wide/narrow, speech processor on/off, and SWR forward/reflected. ICOM's judgment was sound on all but the speech processor. We'd really prefer to have that switch located on the front panel, particularly since the access port will be completely inaccessible in most mobile installations. On the bright side, ICOM's speech processor is exceptionally clean and distortion-free. If properly adjusted, there is no reason why it can't be left on all the time.

On the left side of the rear panel are the power socket, ground connection, and antenna connector. The middle area is occupied by the heat sink and fan for the final amplifier. On the right side is a jack that can be wired for either memory backup or amplifier relay switching. There are also jacks for ALC input, speaker output, CW key, and a multi-pin accessory socket with all the necessary signals available for transverters, phone patches, and band-switching for the IC-2KL linear amplifier. There is no direct access to the microprocessor as there was with the IC-701.

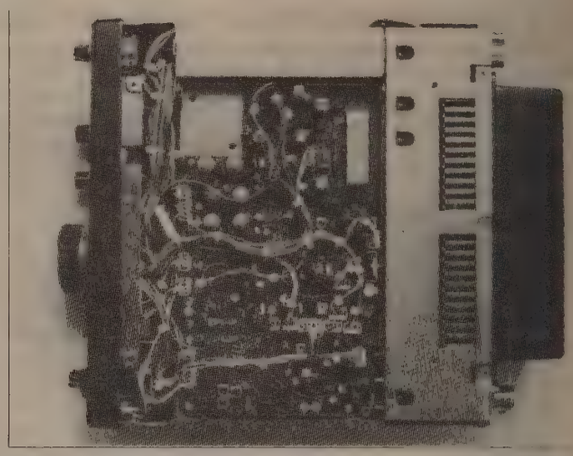


Photo B. Top view of the IC-730. Note liberal use of wiring harnesses and plug-in connectors.

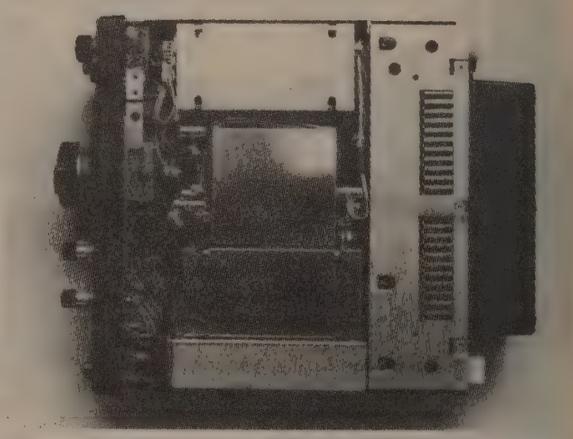


Photo C. Bottom view of the IC-730. Note the extensive internal shielding.

Photo A. Front view of the IC-730.

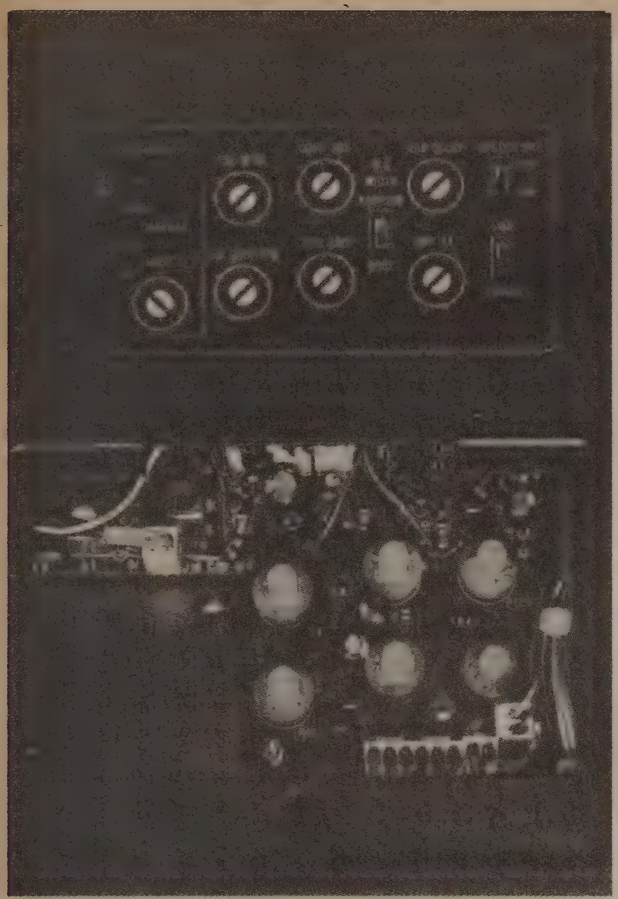


Photo D. Access port on top of the unit. The blank space in the bottom left corner is for the optional marker unit.

Inside the IC-730

The layout inside is light years ahead of its predecessor. There is liberal use of small boards interconnected with plugs and jacks, making servicing easier on everybody. A great deal of internal shielding is employed, which probably accounts in part for its immunity to RFI from microcomputers.

The instruction manual is reasonably good, although it is obviously targeted at the appliance operator. Some Japanese manufacturers (like Yaesu) are including more and better service information with each new rig they introduce. ICOM seems to have taken a step backward, for the manual supplied with the IC-730 is not as complete as the one we received with our IC-701! The IC-701 was supplied with charts of voltage readings at critical locations and more or less complete sections on theory of operation and alignment. No alignment instructions are furnished with the IC-703, and the circuit description is not particularly informative since no mention is made of specific components. Fortunately, there is a large foldout schematic, and an even larger board layout diagram. Emergency repairs could probably be made from this information, but hams planning to take on their own maintenance and repairs by choice or necessity would do well to pester ICOM America for more complete service data.

The Power Supply

Our review sample was supplied with the IC-PS15 power supply, rated at 12 VDC and 20 A, with a 10-minutes-on, 10-minutes-off, 50% duty cycle. It is well regulated and probably adequate for casual operators, but contesters and serious CW operators might do well to look into a heftier supply. As is the case with many 12-volt power supplies from transceiver manufacturers, the PS15 is designed to work only with the rig it matches, so it can't be used with other station equipment. Moreover, it only superficially matches the rig in appearance and lacks the traditional front-firing speaker. Considering the price tag, a hefty well-regulated 20- or 30-amp supply from a reputable power supply manufacturer might be a better choice.

Accessories

The IC-730 is supplied with a preamplified hand microphone, a bag of plugs, and a hefty DC power-supply cable. Accessories available at extra cost are a marker unit with output every 25 or 100 kHz, a 500-Hz CW filter, a CW audio filter, full passband tuning, base station microphone, scanning hand-held microphone, mobile mounting bracket, external speaker, phone patch, and power supply.

On the Air

From the moment you turn it on, it's obvious that the IC-730 is a top-notch rig. We were a little concerned about the quad-conversion design and birdies, but the 730 uses up-conversion with IFs at 39.7315 MHz, 9.0115 MHz, and 455 kHz, reducing these problems to a minimum. Careful listening without an antenna turned up a couple of weak birdies inside the ham bands, but they didn't even move the S-meter. Outside the ham bands, we found only a few louder signals, ranging from S-3 to S-5. Not bad!

RTTY operators should note that the IC-730 is very well protected against RFI from microcomputers. With an antenna located some distance away, we placed the 730 three inches away from a disk-equipped TRS-80 Model III and heard no RFI at all. Most other rigs we've tested suffer varying levels of interference under these conditions.

Received audio quality is excellent, and there's lots of it. We used the IC-730 in a noisy car for several weeks without any external speaker, and it was fine. There seems to be more high-frequency audio available than there was in the IC-701, which makes speech easier to understand. As with every other rig we've tested, lots of internally-generated hiss and noise can be heard, even when no antenna is connected. Transmit audio was excellent, with most other hams reporting that audio quality was best with the speech processor in the "on" position. On the negative side of the ledger, the cooling fan runs continuously in the transmit mode, and also in the receive mode if the rig is overheated. We found noise from the fan slightly annoying in a quiet room, although it is much quieter than the fans in high-power amplifiers.

As for general receiver performance, the IC-730 seems to be more sensitive than the IC-701, and audio quality is substantially improved. Dynamic range was quite good, too. Serious CW operators will probably not be happy until they install a CW filter, however.

We really don't enjoy torturing equipment, but we felt obligated to run a few tests in the interest of science. With the rig in the transmit mode at full output, we flicked off the power switch and turned it back on again a few seconds later. Another solid-state transceiver we were considering for review blew an internal soldered-in fuse when subjected to this treatment. It took an hour to find and replace! The IC-730 (and the PS15) showed better manners and never missed a beat. While some might consider this test un-reasonable, it is vital that a rig be able to pass it if it is expected to operate under emergency conditions.

To test the SWR protection circuitry, we transmitted into a variety of less-than-perfect loads. We also tried a couple minutes of transmission with no load at all. No problems developed. We performed similar tests on our IC-701 when we first received it, and after three years of hard use, often under less than optimal conditions, the original finals are just fine, thank you! While there is undoubtedly a particular combination of load, rig, and idiot that will blow the finals, all indications are that the IC-730's final amplifier will be highly reliable.

Hams who find an attenuator indispensable should be aware that there is none on the IC-730. In all fairness, we must say that while we have encountered many operators who have professed great regard for these devices, we have never seen them actually use one on a modern rig!

Conclusions

Several months of use have left us with nothing but respect for ICOM's compact HF transceiver. Indeed, returning it leaves us with a feeling of great loss! The only thing we'd like to see added is a good notch filter and perhaps a RTTY input for direct FSK. Practically speaking, though, neither of these are available on other compact transceivers.

For our style of operation, the IC-730 is one of the best transceivers we have yet encountered, regardless of size or price. Most intriguing of all, it appears as though the little IC-730 might stand up well to the rigors of DXpeditioning. If you are looking for a small transceiver but are unwilling to compromise on performance or give up features, the IC-730 deserves serious consideration. RF

Reprinted from 73 magazine, October 1982.

the tech side

by Michael Jay Geier KB1UM

I Want a New Rig!

For the past several months, we've been looking at the process of buying new amateur radio gear. So far, we've covered walkies and VHF/UHF mobiles. While the investment for those radios can be considerable, it usually isn't as high as for HF gear. Radios for the low bands are pretty complex inside, and they can cost a bundle! Some, though, are fairly reasonably priced, even though they offer enough features to allow you to have a good time. So, let's get started with our look at HF radios.

What Do You Need?

That depends on you, and on your license class. If you're a no-code Tech, you don't have HF privileges. That doesn't mean, though, that you don't want an HF rig, because you might be planning to upgrade. Often, new hams start out listening to HF and wind up getting hooked on it enough to upgrade, even though they didn't intend to in the first place! The thrill of contacting stations outside the local area has always been, and continues to be, at the heart of the amateur radio experience. VHF/UHF is a blast, but HF gives you the world.

You also might opt for an HF rig because you love shortwave listening, also known as SWLing. There are some HF rigs which cover only the ham bands, but most modern ones cover from about 500 kHz to 30 MHz continuously, giving you all the government and commercial shortwave bands. While a good consumer-grade shortwave radio can give you plenty of listening pleasure, nothing beats the performance of a real communications receiver of the kind you get in a ham rig. The frequency stability, adjacent-channel rejection and resistance to overload are much better. For listening to AM shortwave broadcasts, the price difference may not be worth it. If you want to listen to SSB (single sideband, used by hams, government, military, etc.), though, you are likely to be disappointed in many of the consumer sets. Some don't offer it at all. Among the ones that do, some are not too bad and some are utterly unusable. And, RTTY (radioteletype), SSTV (slow-scan television) and CW (Morse code) require good-quality SSB reception; I've never yet seen a consumer shortwave that could receive RTTY and SSTV well enough to give you any useful results. While you may have no interest in these modes right now, you might be surprised at how ham radio will lead you into new pursuits as the years roll by.

On The Air

If you do have HF privileges, I can promise you you'll be pining for an HF rig sooner or later. If you're a Tech Plus, 10 meters may be your first consideration. Right now and for the next couple of years, though, 10 is going to be pretty bad, thanks to our being near the bottom of the natural 11-year solar cycle. In good years, you can hear the whole world booming in on 10 but, right now, you'll be lucky to hear anything. Some days do have some propagation, but at night the band is as dead as the proverbial doornail.

Of course, you also have CW privileges on some of the lower frequency bands, and those are still quite useful, even with today's poor solar conditions. Some days 15 and 17 meters are open, 20 and 30 are open just about every day, and 40, 75 and 160 are open all night. If you're a General Class or above, of course, the world of voice, RTTY and all the rest is at your command on these bands.

There are three basic kinds of HF rigs: full-featured, stripped-down and low-power (QRP). Naturally, the full-featured ones cost the most. But, when I say stripped-down, I don't mean the lower-cost multiband radios that don't have lots of knobs for setting the receive passband and things like that. I still consider those full-featured, just not as much as the more expensive transceivers. I'm talking about the little sets that have very little on them and typically only cover one or two bands. Included in this category are the 10-meter-only mobiles that put out 10-25 watts. Let's take a look at a few types of rigs.

> ***"There are three basic kinds of HF rigs: full-featured, stripped-down and low-power (QRP)."***

The Works

Full-featured rigs start at around $800 and go on up to prices not too far below the small-car range! You'd be amazed at what some people spend on this hobby. Not that I'm putting them down . . . if I had plenty of money, I'd have a station the size of a small broadcast station. Why not? But, in the real world, most of us don't have that kind of cash, and we must do a little settling when we buy. These days, though, you get a lot of radio for your money. The big sets, costing perhaps $1,300-$2,500, have everything you can possibly imagine. Direct keypad frequency entry, independently selectable high and low cut controls for the receive passband, notch filters, digital processing, you name it. One very expensive radio even has a built-in video monitor which shows memories and other operating characteristics, along with received RTTY data! Do you really need all that stuff? No, but sometimes some of it can be very nice to have. All you really need to communicate is a tuning knob, a mike and an antenna. When somebody keeps tuning up right next to your frequency, though, that notch filter comes in mighty handy. And all those memories and the direct entry really help you zip around the bands, which is great for contesters, but can be done without by most of us.

There is one feature I consider essential: the ability to modify the receive passband. Some of the bands are very crowded, and the QRM (interference from other stations) can drive you crazy on voice or CW, and can make RTTY and SSTV reception impossible. Having a passband tuning or IF shift control lets you cut some of that junk way down, making operating a lot more pleasant. Some less expensive radios don't have such controls, and I don't recommend them. In fact, I own one myself, and that glaring lack is what will eventually get me to spring for a new radio one of these days.

Another feature which can be important is the duty cycle of the transmitter. What I mean is how long you can stay in transmit before the thing overheats and must be switched back to receive. For SSB voice operation, it isn't an issue. Even with a speech processor (another very valuable feature), voice operation just doesn't make the final RF amplifier work hard enough to overheat, and nearly all rigs can transmit voice for very long periods. On CW, the spaces between the dits and dahs keep things pretty cool so, again, duty cycle isn't a big issue. When you try RTTY or SSTV, though, it's entirely another matter. These are what are called "continuous duty cycle" modes, because they require the radio to put out full power at all times during transmit. They make your radio run hot, and some rigs can't take it at full power. Many of them suggest you turn the power down to half, usually 50 watts, which isn't too bad, because that's only 3 dB down from the usual 100 watts. If you have to drop the power much more than that, though, you'll wish for a more rugged radio. By the way, the power supply you use also affects the duty cycle, and we'll get to that a little bit later.

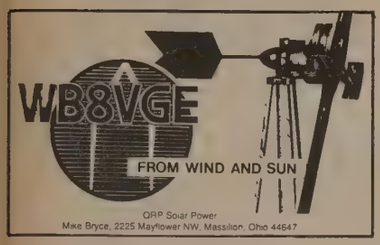
Take It All Off

The lowest-cost non-QRP radios are those 10 meter mobiles, Really, they're reworked CB sets. Does that mean they're bad? Not necessarily. Depending on what you use it for, such a radio can be a cheap ticket to lots of fun. Heck, at hamfests, you can sometimes find them for $100 or less, and they're never very old because the sets have only existed for a few years. Their performance is not bad, but it doesn't compare to the bigger radios.

Your primary use for such a radio is SSB voice operation. You won't have a lot of output power. When 10 meters is open, though, it tends to propagate very well, so you don't need much power. But, as I said, 10 won't be hot for a couple of years yet. Frankly, I think you'll be disappointed if you buy one of those rigs at this time.

Actually, there's an intermediate class of radio which has recently appeared. A good example is the Ten-Tec Scout. At $549, it's quite a bit more expensive than one of those reworked CBs. But, it's much more of a real ham rig. With 50 watts output, you'll make far more contacts. It has a more sophisticated receiver, and plug-in band modules let you work any band you want. Of course, once you buy a few modules, you still have a sizable investment. I don't mean to single this radio out, one way or the other, because I've never actually used one; it's just a good example of its kind.

Well, I promised we'd talk about QRP rigs and power supplies, but I'm running out of room. So, we'll get to it next time. Until then, 73 from KB1UM. RF



radio magic

by Michael Bryce WB8VGE

As we dig deeper into a schematic, you'll notice how several simple circuits make up one complex part of the rig. You'll see this time and time again as you look at different schematics. You'll really notice this when you look at a piece of consumer-grade electronics like a VCR or television. In most consumer electronics, you'll see the same circuit used over and over again, with few, if any, changes made. The basic circuit always remains the same. This is especially true for power supply assemblies and RF sections such as varactor controller tuners for VCRs. In consumer electronics, the main purpose for all of this is to reduce cost. Why pay someone to design an audio amplifier for your newest TV when you can use the one from last year's model?

Is your new rig a "consumer" electronic item? I'm not sure, but I do know that the basic idea is always the same—they use familiar well-engineered circuits. The only exception would be if a new design greatly reduced the overall part count, thus saving money, weight and space. Or, if the new design made for a substantial saving in energy consumption as in a laptop computer or cell phone.

This "basic building block" can be a savior for us when it comes to fixing our equipment. If you've seen one audio amplifier, then you'll more than likely see it hundreds of times again.

The Inzas and Outsza

If there is one thing in life I don't want you to forget, it's this: In anything electronic, you have to have an input and that must produce an output. This rule should always be number one in your first line of logic when working with a dead rig, or when learning how to read a schematic. Let's look at a simple audio amplifier.

"If there is one thing in life I don't want you to forget, it's this: In anything electronic, you have to have an input and that must produce an output."

This circuit is quite simple. It's a building block, just like we talked about earlier. It's been in so many QRP rigs that it's become a classic all by itself. In our amplifier, we have two inputs and one output. If either of them is missing the circuit won't work. In some cases, the amplifier may in fact produce strange results from the lack of an input or output. You are probably wondering what the two inputs and the one output are by now. Look at the Figure 1. The first input is the +12 volts to the VCC pin of the amplifier. Needless to say, without the proper supply voltage here, the amplifier will do nothing. A quick voltage check will verify that the proper voltage is at the pin.

Although not really an input, everything must have a return to ground for the VCC line. A floating ground on a PC board is a common failure. Many of the manufacturers make a ground connection to the PC board by the mounting standoff and its screws. A loose screw on any of the mounting standoffs may trigger an open ground, thus making the entire PC board look dead. Also, if you're working on an older rig with many PC boards on one chassis, the first troubleshooting step is to tighten up the mounting holding the many PC boards in place.

The next input is the low-level audio coming in from the volume control. No input, no output. You can check to see if there is an input at the center of the volume control by using a signal tracer or an oscilloscope. If the device is powered by batteries, with no line-powered transformers, then touch the center terminal of the volume control with your finger. A loud hum will be produced if the amplifier is working. *Don't* try this with a rig running on 110 volts. You might produce the loud hum instead of the rig!

Now that's our two inputs. They must both be there for the amplifier to work. The output of the amplifier must also be present. In this case, the output is a small speaker. If you have the +12 on the VCC pin, a low-level audio input, and still no output, then either the coupling capacitor, the speaker or the audio amplifier chip is kapoop. A simple test to check the speaker is to turn the power on and off as you watch the cone of the speaker. If you see it move in and out or hear a thump, the speaker and its connections/external speaker jack are in working condition. If you don't get these results, then it's time to dig deeper into the *output* side of the amplifier.

For the sake of example, let's say the speaker is good, but we still have nothing coming out of the speaker. Now it's time to move closer to the audio amplifier chip and take a look. An oscilloscope on the very input pin should show the low level audio *at the input to the amplifier.* If the input is there, 12 volts is present and the speaker is good. Then the only thing left is the audio amplifier itself.

Sometimes you can tell the well-being of a power chip like the LM386 by touching it with power applied to the circuit. If the chip is hotter than ambient temperature, something is wrong. I would bet the farm on a leaky coupling capacitor. If the capacitor is good I would start looking for oscillation caused by a bad decoupling capacitor on the VCC supply line.

As you can see, once you start taking the circuit apart, in its basic form, it becomes easy to figure out. If you're missing just one input chances are the circuit will not perform as planned.

Even though the example I've shown is quite simple, the same logic applies when reading a schematic from a rig you're not familiar with. Break the schematic down into bite-sized bits. Look for the inputs to that stage and the necessary outputs. Something as complex as a phase-locked loop (PLL) needs a reference input. Without this input the PLL will not work.

Next month we'll look at more examples in schematic reading. We'll also take a deeper look at kit building. I've been overloaded with mail about how to build kits. RF

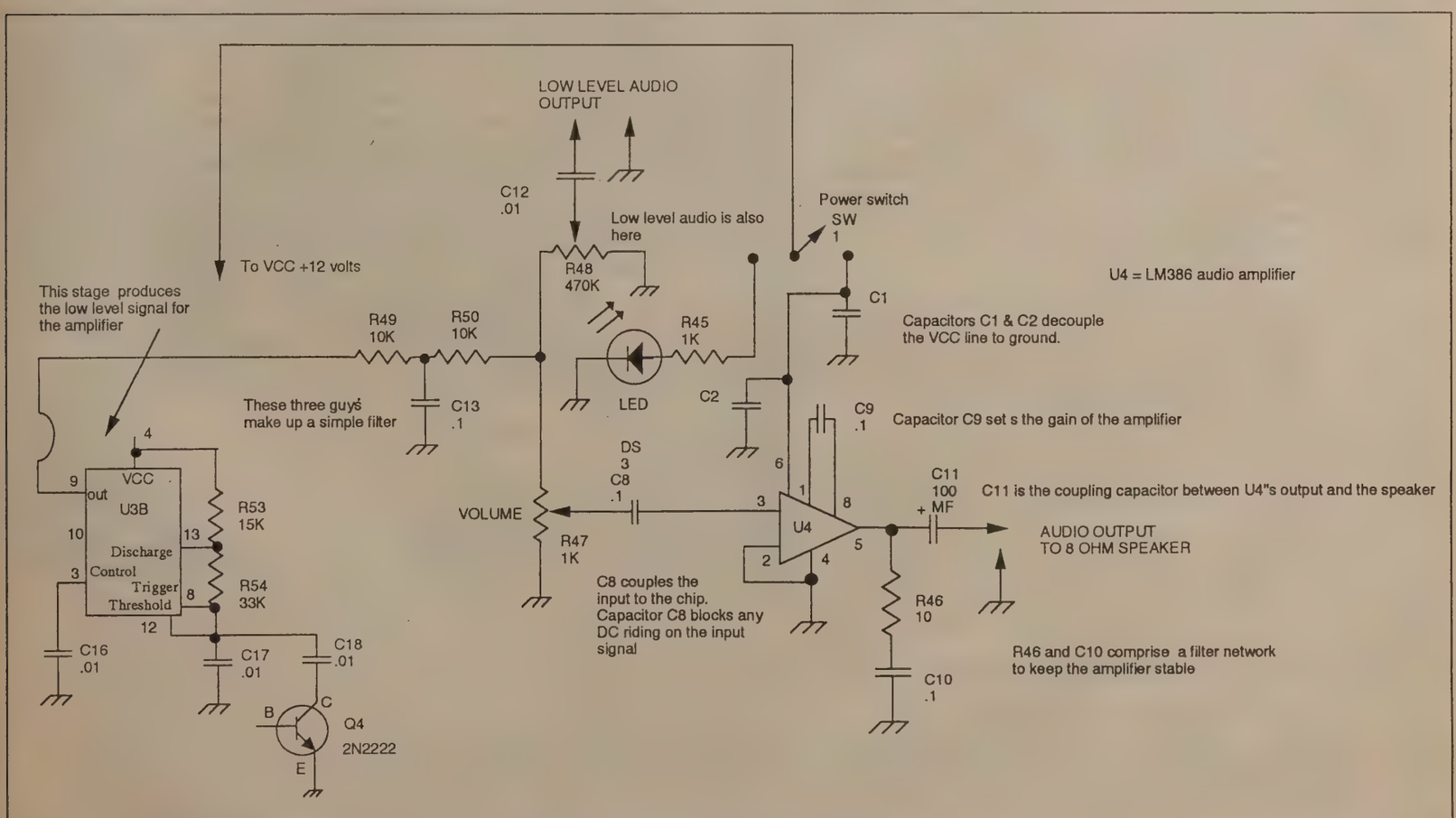


Figure 1. Circuit for a simple audio amplifier.

Joe Carr's antennas, etc.

by Joseph J. Carr K4IPV

A Multiband Wire Antenna

Recently this column looked at the G5RV antenna (more about that later). This month we will take a look at a very old-fashioned antenna design that is also of the multiband wire variety. The one time that I used this type of antenna for any length of time, it was a real success. Also, a missionary ham told me that he and his wife used it all over Africa for nearly 30 years because it was effective, cheap and portable. This antenna is the Center-Fed Multiband Dipole (CFMD).

The basic CFMD is shown in Figure 1. This antenna consists of a half-wavelength radiator fed with 400- to 600-ohm parallel open feedline (a.k.a. ladder line). The transmission line is a resonant feeder (unlike coax, which is non-resonant) because a non-resonant feeder would provide a good impedance match only at one frequency. Also, the current loops tend to shift with frequency.

The open feeder is an air-dielectric transmission line, and is used because solid dielectric lines are not suited to harmonic operation. The feed-point impedance is frequency-dependent, and varies from about 70 ohms to about 5,000 ohms as a function of frequency. As a result, an antenna tuning unit (ATR) designed for parallel feeders is needed at the input to the feedline.

The antenna is approximately a half-wavelength long at the lowest frequency of operation. According to an early 1960s edition of Bill Orr W6SAI's *Radio Handbook,* and a 1952 edition of the *ARRL Radio Amateur's Handbook,* a CFMD cut such that L1 is 136 feet and L2 is 68 feet, will work on 3.5, 7, 14 and 28 MHz if a parallel tuned ATR is provided (some length/band combinations require series tuning, and both sources provide tables for design selection).

The antenna can be made of ordinary #12 or #14 antenna wire. That same wire can also be used to make the parallel open transmission line, as well. I've been surprised at the number of times in recent years when I've seen dealers and individual hams at hamfests selling the ceramic spreaders for parallel line. You can also buy rolls of surplus open line at hamfests. For power levels under about 250 watts, one can usually substitute 450 ohm twin-lead for the parallel line, although some sources claim it won't work as well.

Some years ago, when parallel "ladder line," and the spreaders needed to make your own, were becoming hard to find in stores, a magazine suggested using old tooth brush handles for the spreaders. If one follows one oral hygene recommendation I've seen published—a new toothbrush ever three months—then you could build the 66' feedline for one of these antennas every 33 years if you used 6" placement between insulators, or every 16.5 years if you used 1' placement. Wow!

Parallel line can be home-brew constructed using instructions found in the two books listed above, or in my own *Practical Antenna Handbook,* 2nd Edition (see "Uncle Wayne's Bookshelf," page 27 of this issue of *Radio Fun*).

One of the characteristics of the CFMD is that it is a little finicky to keep tuned. Even relatively small frequency shifts will require retuning of the ATR. Bill Orr provides the design in Figure 2 as a means for flattening out some of the impedance excursions one sees with changes of frequency. This antenna is a kind of "bow-tie" design in which each half of the radiator consists of two conductors that are joined at the feed point, but spread apart at the ends by about one inch. The far ends, by the way, are not open-circuited, but are shorted together. According to Orr's book, the feedline can be either 33 or 66 feet of 300-ohm twin-lead, provided that the power level is kept to 150 watts or so (I've had 300 ohm twin-lead—which was intended for TV receivers—melted by a kilowatt linear amplifier!

It wasn't my rig—I may be a dumb country boy, but . . .).

G5RV Controversy and Update

Whenever I write about the G5RV (except in European magazines) I expect to get two polar results: those wildly enthusiastic about the antenna and those who hate it ("the antenna from hell . . . " said one). Oddly, there are few opinions in-between.

One reader wrote and took exception, but offered some positive information. He stated that he'd replaced the coaxial line with parallel open feeders and experienced a large increase in performance. He also stated that G5RV is stating this position as well, although I haven't yet looked up the reference that he provided. One criticism that is well-taken is that I used the word "dipole" a little sloppily (and will continue to do so, but with an explanation). He claimed that the G5RV is a dipole, while I said it was not. Bingo! It is balanced with respect to ground, hence it has two ("di") poles, so it's a dipole. However, common ham usage for the many decades I've been hamming is to render the word "dipole" as meaning a "half-wavelength resonant two-pole antenna fed in the center with coaxial cable," unless there are adjectives to modify the meaning (e.g. "3/4 dipole"). I'll continue that usage, but be more careful to explain it when I do so.

One thing bothers me, however. Of four letters I received, only one was vehement about the topic, the above letter was critical, and two approved because of good experience with the antenna. It's always amazed me how some people get so purple-faced livid over antennas . . . it's like no other topic in ham radio! Once, when writing for another magazine, I received a blistering letter, assailing my parentage, for "providing false information to unsuspecting hams." I'd stated that the feed point impedance of a vertical antenna can vary from " . . . a few ohms to 37 ohms . . . ," and my correspondent (polite term) used five pages of calculus to prove it can vary from about 3 ohms to 36.6 ohms. As far as I could see, the difference between "few ohms" and "3 ohms," on one hand, and "37 ohms and 36.6 ohms" on the other is a moot point. My point is this: It's only an antenna, people! Write with criticisms (that's how we all learn and grow), but be polite. For those who get in a crude, vulgar mood over something like an antenna design one can only say "get a life!" This ham stuff is supposed to be fun, remember?

New Books

The new *ARRL Antenna Handbook* (see "Uncle Wayne's Bookshelf") is out, although I didn't get a chance to buy one until just before last Christmas. It is another winner for the Newington crowd . . . and congrats are in order. This edition has some software included on an IBM-compatible diskette stuck inside the back cover. I'll be reviewing that software sometime in the future either in this column or my *73* column.

Correspondence will reach me at P.O. Box 1099, Falls Church, VA 22041. RF

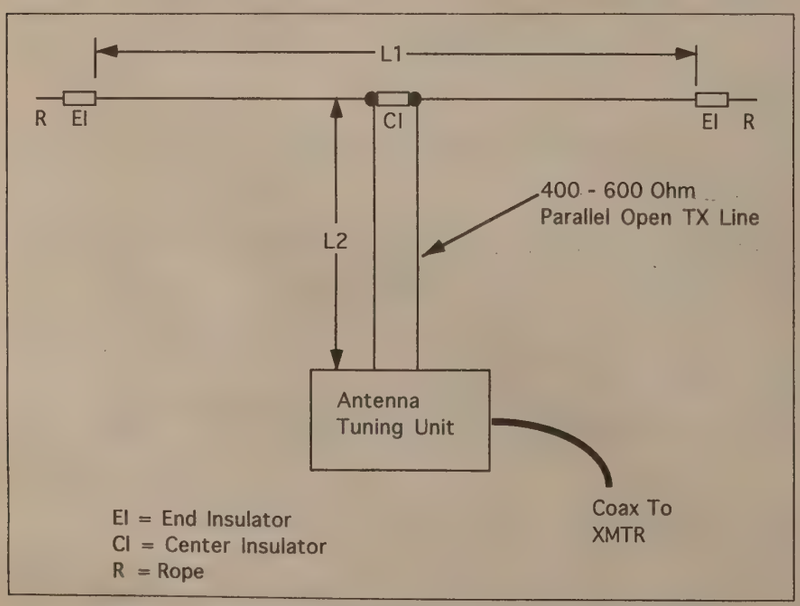


Figure 1. The Center-Fed Multiband Dipole (CFMD) antenna.

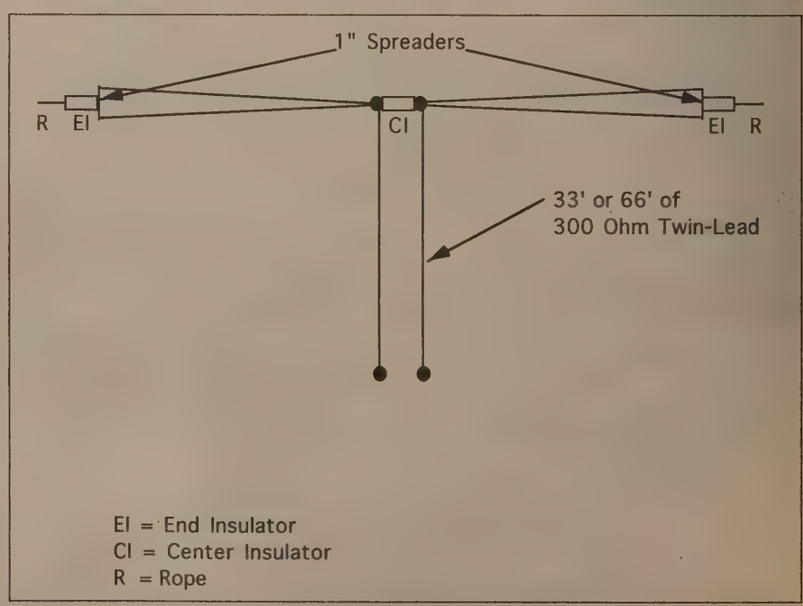


Figure 2. A "bow-tie" CFMD antenna design.

what's next?

by Carole Perry WB2MGP

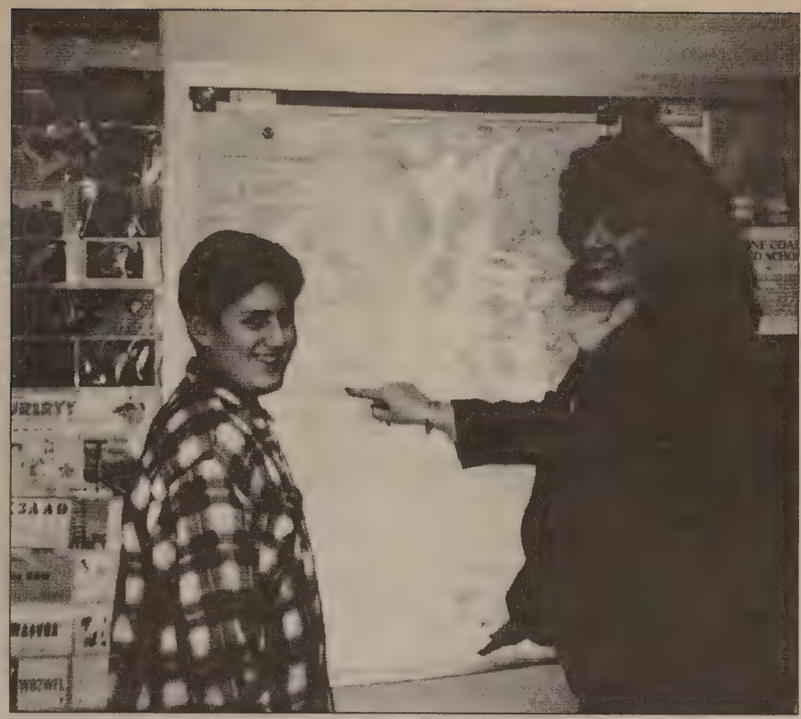


Photo A. It was fun to plot Jim's course between the different islands. At left is eighth-grader Bobby Giarratano.

Ship Ahoy with Ham Radio!

In the April edition of my "Hams With Class" column in *73 Amateur Radio Today* you read in detail about the incredible "Lobster-Radio Day" we had at my school as a result of a radio contact. For the past term Jim Wilmerding N4MDC, Project Director for the Island Institute in Rockland, Maine, and I have kept our respective students in touch with each other via amateur radio.

Jim oversees 14 island schools off the coast of Maine in the scenic area of Penobscot Bay. The Island Institute provides educational resources to the small, predominantly one-room schoolhouses on these small fishing islands. When we first decided that it would be a great educational experience for my sixth-, seventh-, and eighth-grade ham radio classes on Staten Island, New York, to speak with youngsters in grades K-8 on these islands, we had no idea how successful we would be.

The comparing and contrasting of Staten Island with the various islands we connected with was a tremendous experience for all the children. Our intermediate school has more than 1,800 children with a staff of over 100. The first school we contacted, in Frenchboro, had a one-room schoolhouse with eight students. Can you imagine how many great questions the children had for each other over the radio?

One of the areas that was of interest to the children at both ends of this cultural exchange was the transportation. My students gathered information about the famous Staten Island Ferry and relayed it back to the island school children. It was hard for them to imagine that in the fleet of ferries going between Staten Island and Manhattan there is one named the *Samuel Newhouse* that holds up to 6,000 passengers. The smaller vessels can accomodate 1,280 people and up to 40 vehicles. Two of my students videotaped the five-mile ferry ride into the pier at New York City, including footage of the Statue of Liberty, Ellis Island, the Brooklyn Bridge, and other famous landmarks that can be seen from the ferry.

The children at Jim's end enjoyed these exchanges immensely and sent up a video of the ferry that crosses between the islands carrying about 17 people. My students watched the video in amazement as kindergarten and third-graders appeared holding lobsters and crabs aboard their fathers' boats. It was wonderful for my New York children to see how their counterparts in another region of the United States spend their days.

Huge cartons filled with scrapbooks, photo albums, reports, video and audio tapes went out to Frenchboro and Chebeague Island Schools. After several weeks we had spoken with five of the island schools. My students were thoroughly delighted with every radio contact. Many pen-pal exchanges began as the children started to form friendships on the air. The January 12th arrival at our school of six live Maine lobsters literally had my entire school hopping with excitement. You can read more about what we did with the crustaceans in the *73* article. It was a wonderful experience! The kids really got a "taste" for radio.

Photo B. Frenchboro Island, Maine, students enjoy a classroom QSO with WB2MGP. Teachers Jim and Heather are surrounded by excited youngsters.

Map Contact

Among the packages of "goodies" that Jim sent us was a set of three nautical maps. The three charts could be mounted side by side across the front of my room to give a full view of the coast of Maine from Portland eastward. Since these were actual charts used by vessels that navigate coastal waters they contain a tremendous amount of information that can be used by a boat for safe transit amongst the islands of Maine.

The kids were enchanted with the charts. They discovered the key on their own. From the key we were able to make a list of vocabulary words on the board. We discussed and researched words like: distance, scale, compass bearings, water depth, bottom condition, aids to navigation, and electronic bearing (LORAN C).

My classes were soon using longitude and latitude lines to calculate coordinates such as those of the island schools. Jim suggested that we use the "Compass Rose" to plot courses to steer between locations. We talked about the difference between True and Magnetic North.

During the weeks following the arrival of the charts, the children were hard at work for 10 minutes out of each period that I met with them, plotting the course that Jim would take from his home island to the island he would be speaking to us from that week. Some of the kids really got into the nautical theme and were able to do calculations with knots.

Ham radio in a classroom literally opens up new worlds for young people to explore. Whenever I begin a new project each term, I try to anticipate what all the new learning experiences will be. I'm always surprised when the units just start to take on a life of their own. Areas of study involving geography, climate, cultures, space travel, agriculture, computers, and navigation are just the tip of the iceberg in a ham radio classroom.

The many fascinating lessons we learned with the nautical charts were just one part of a great learning experience we enjoyed as a direct result of the radio contact with the island schools in Maine.

If you've had a unit of study that was especially exciting as the result of an interesting radio contact you've had in a classroom setting, please write me about it so that we can share it with other teachers and instructors. RF

upgrade . . . don't stop now

by Gordon West WB6NOA

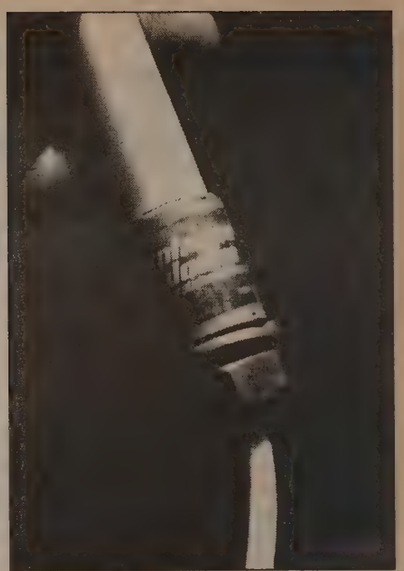


Photo A. Look at where the coax enters the antenna. Is it sealed against the water coming in?

Why Collinear Antennas May Work Better

Most newcomers to amateur radio get started on the 2 meter and 440 MHz bands. Now that dual-band hand-held and mobile units have been priced about as low as what single-band sets were selling for a couple of years ago, having one radio that does both bands in one nice, neat package makes sense.

The dual-band transceivers may also tune in out-of-band signals like aircraft calls, police, fire, railroads, marine band, and the emergency medical paramedics up on the UHF 460 MHz frequencies. Reception of these services is permissible without a violation of any Privacy Act rules. However, most new dual-band mobile and hand-held radios no longer have capabilities of tuning in 800 MHz, which is the taboo (and illegal) reception area of cellular phone transmissions.

But tuning in the ham bands and adjacent-frequency aeronautical and public safety bands requires a good antenna. For a handheld, best reception is achieved with an outside antenna on your car roof or housetop. For mobile single-band and dual-band VHF/UHF transceivers, an external antenna is an absolute necessity.

Choosing an Antenna

VHF/UHF mobile antennas and base antennas come in many sizes, shapes, and lengths. The longer the antenna, the better the distant line-of-sight reception to most other stations. Both mobile and base antennas are rated in the amount of decibel gain that they are able to achieve.

How can an antenna be made more powerful by making it longer? Remember that question on your Technician exam that asked, "Which antenna has more gain—a 1/4-wave vertical or a 5/8-wave vertical?" Think of your antenna as a 25-watt light bulb on the end of an extension cord, held upright. The amount of light that goes straight up is equal to the amount that goes out to the sides. If you were to cut an old tennis ball in half and place it on the roof of your car, this would illustrate the radiation pattern of a 1/4 wavelength spike for either 2 meters or the 440 MHz band. That is, your radio energy goes out in all directions and in all elevations, like that light bulb.

But why illuminate the sky with your signal? Most of the stations you want to work are down close to the horizon, or up 20 degrees to distant repeaters. How can we take some of that wasted sky-bound energy and combine it with the low-angle signal to make it stronger? By using a collinear antenna.

Think of the collinear antenna as a reflector on the top of the light bulb that redirects the energy going straight up into a combined illumination down close to the horizon. The collinear antenna takes wasted straight-up energy and combines it with useful energy down close to the horizon. This is accomplished by stacking 1/4-wave or 5/8-wave elements end to end as a collinear array. The number of radiating elements stacked end to end will determine how much gain can be achieved close to the horizon, and increased gain generally means a longer communications range on both 2 meters and the 440 MHz band.

Decibel Gain	Power Gain
0.0	1
3 dB	2
6 dB	3.98
8 dB	6.31
10 dB	10

If you visit your local amateur radio dealer, chances are you'll see a wall devoted specifically to hanging mobile and base station single-band, dual-band, and triband gain antennas: Austin Antenna, Comet Antenna, Cushcraft, Diamond, Hustler, Hy-Gain, Lakeview, Larsen, MFJ, Max System, Valor. Each of these companies produce collinear gain antennas which radiate vertically-polarized waves in all horizontal directions, and significant gain is achieved by taking wasted sky-bound energy and directing it down into the main lobe close to the horizon.

For base stations, you will begin to easily hear distant repeaters and simplex stations on a mobile unit that you could not hear before when you choose an antenna that is 10 to 15 feet tall with 8 dB of gain on either band. These are usually Fiberglas antennas with the copper elements safely housed on the inside, or rugged aluminum antennas with Fiberglas phasing networks seen interspersed up the shaft. These antennas require no additional ground plane, and will give your base station's transmission and reception a major boost over a simple ground plane that you may have built out of coat hangers and have hanging in the rafters.

Car Antennas

For your car, you must be more careful on how much gain you select. Keep in mind that more gain means a taller antenna. Taller antennas can sometimes have problems with overhanging trees, garage doors, and florescent light tubes in drive-through food places!

If you run your hand-held or mobile unit mainly in the city as you drive around, a 3 dB gain antenna not much longer than two 12" rulers stacked end to end should work well. This gives you increased gain down close to the horizon, but not *so* close that you rob useful energy up 40 degrees to mountaintop or building-top repeaters. A mobile antenna with too much gain could actually undershoot a mountaintop repeater, and cause your signal to "picket fence" as the extra-long whip rocks back and forth at high speeds.

However, if you operate out in the boonies where repeaters are up to 50-75 miles away, you need a mobile antenna with as much gain as possible. You should select 6-8 dB gain (UHF) with a yardstick-long, dual-band or triband, mobile collinear that will give you the signal concentration necessary to work those distant repeaters that everyone else around you with just a little spike on the top of their car can barely hear. I have tried the Diamond and Comet mobile collinear yard-long antennas, and they work well and also have the capability of "lift and lay," where you simply tug up on the antenna and a spring action allows you to lay it down to get into a low garage. And if you're absentminded, you might go for the Maldol power mount to lay down this monster mobile antenna electronically, with the capability of a slip-clutch to lay down in case you forget to do it! Most mobile antennas feature open coils for signal phasing, and it's important to keep these antennas as clean as possible because moisture and dirt can disturb these important matching sections.

Finally, just the amount of gain out of a mobile or base station single-band, dual-band, or triband antenna is determined mainly by its overall height. Gain figures on the specification sheets or in the ads are sometimes referenced to sub-gain imaginary or "rubber duckie" antennas, so apparent whopping gain figures show up on the spec sheet. Gain can only be achieved by stacking elements vertically, and the taller the antenna, the more gain you get down close to the horizon.

If you're looking for a great way to boost both outgoing and incoming signals, the collinear array gives you omnidirectional performance in a big way! RF

Photo B. The Shakespeare (Valor) 9 dB gain antenna uses brass rod stock to increase gain.

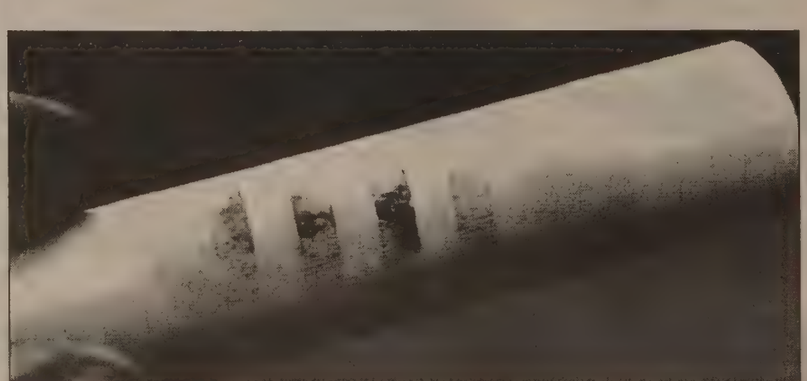


Photo C. One VHF antenna maker, Universion Systems, uses embedded foil to increase performance on the collinear array.

Photo D. 3 dB gain single-band mobile antenna with phasing section in the center.

Uncle Wayne's Bookshelf

BOOKS FOR BEGINNERS

W5GWNC **Technician Class License Manual: New No-Code** *by Gordon West* This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **$9.95**

XTAL-1 The Crystal Set Handbook by Phil Anderson WØXI. Want to give a kid an exciting present? Or maybe yourself? Crystal sets are alive and fun. Here's a whole book packed with crystal set circuits that anyone can build. You may get interested enough to join the Crystal Set Society and get their newsletter. Now start saving those oatmeal boxes, okay? 133 pages **$10.95**

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09S42 **The Scanner Listener's Handbook** *by Edward Soomre N2BFF* Get the most out of your scanner radio. **$14.95**

CRBSM1 **Scanner Modification Handbook, Vol. 1** *by Bill Creek* provides straightforward step-by-step instructions for expanding the operating capabilities of VHF scanners. **$17.95**

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TAB 339643 **Tuning In To RF Scanning** From Police to Satellite Bands. Bob Kay. 150p 1994, Tab Books. This is a wonderful book for the VHF-UHF scanner listener. It explains about the various radio bands, antennas, the laws, and lists frequencies for every imaginable service . . . including the Secret Service, FBI, military, IRS, prisons, Fish & Wildlife, McDonald's order windows, nuclear search teams, railroads, Russian satellites, Treasury Dept., wireless microphones for concerts, and so on. **$14.95.**

07A66 **Aeronautical Communications Handbook** *by Robert E. Evans* Exhaustive, scholarly treatment of shortwave aeronautical listening. **$19.95**

AR4025 Beyond Line of Sight. This book shows why, as we know today, VHF radio waves can travel thousands of miles. Shows how hams discovered or pushed forward the discovery of the propagation modes that make VHF DX possible: tropo, sporadic-E, aurora and auroral-E, meteor scatter, F-Layer propagation, transequatorial propagation and earth-moon-earth. **$12.00**

TAB 447748 **The Shortwave Listener's Q&A Book**—Everything you need to know to enjoy Shortwave Listening. Anita McCormick. 142p 1994, Tab Books. Choosing receivers, accessories, antennas, frequencies, and getting QSLs. SWL is an exciting hobby . . . that's what got me interested in hamming . . . Wayne. **$12.95**

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RS-1 **The Amateur Radio Mail Order Catalog and Resource Directory, 4th Edition**
is the most comprehensive source book for electronic parts, software, and equipment targeted at the radio amateur or serious electronic hobbyist anywhere! Plus a wealth of "value-added" reference material all in 262 pages. 4th Edition clearance at only **$8.95**. (was $16.00)

TAB4354 **The Beginner's Handbook of Amateur Radio, Third Edition** *by Clay Laster W5ZPV.* 395 pages. This is a wonderful book for newcomers. It is basic and well illustrated. Even if you have all the other ham handbooks, you'll still find this one useful. **$22.00**

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RF 03-04/95

Radio Fun flea market

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Personalized caps, T-shirts, mugs, mouse pads, license plates. Request free color brochure with designs. **Donovan Deily WA3B**, RD2 Box 2088A, Leesport PA 19533-9653. RF234

QRP TRANSMITTERS—3 watt kits and assembled models for 20m, 30m, or 40m. Easy, fun to build! 2 stamps for **"MILLIWATTER"** info. **TECHSONIC**, Plymouth PK-32F, Conshohocken, PA 19428.RF235

X-BAND HANDHELD POLICE TRANSMITTER, one-mile range, $39 plus S&H. **INNOTEK,** One Innoway, Garrett, IN 46738. RF251

WANTED: One Ten-Tec Century 21 CW only transceiver. Must be in like-new condition—original shipping carton would be nice. If repairable by Ten-Tek OK. **Joseph Glaudel,** 412 Huntingdon Pike, Rockledge, PA 19046-4448. RF430

MAHLON LOOMIS, INVENTOR OF RADIO; by Thomas Appleby, (Copyright 1967). Second printing available from **JOHAN K.V. SVANHOLM,** N3RF, **SVANHOLM RESEARCH LABORATORIES,** P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. RF445

PRINTED CIRCUIT BOARDS for projects in *73, Ham Radio, QST, ARRL Handbook.* List, SASE. **FAR CIRCUITS,** 18N640 Field Ct., Dundee IL 60118. RF595

WANTED: BUY & SELL All types of Electron Tubes. Call (612)429-9397, Fax (612)429-0292. **C & N ELECTRONICS,** Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. RF620

QRPers: LOW BAND QRP transmitter plans, $1.00. EASY ASSEMBLY! CAPULET, INC., **P.O. Box 86, Getzville NY 14068, (716) 691-8656. RF795**

FREE HAM GOSPEL TRACTS, **SASE,** N3FTT, **5133 Gramercy, Clifton Heights PA 19018. RF960**

activities calendar

Send your announcements to: Radio Fun Activities Calendar, 70 Route 202-N, Peterborough NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

ANNOUNCEMENT

WASHINGTON, DC The Foundation For Amateur Radio, Inc., a non-profit organization with headquarters in Washington DC, plans to administer 56 scholarships for the academic year 1995—1996, to assist licensed Radio Amateurs. Licensed Radio Amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from $500—$2000 with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Additional info and an application form may be requested by letter or QSL card, postmarked prior to April 30th, 1995, from *FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740.*

MAR - APR

ST. LOUIS COUNTY, MO The 1995 SKYWARN weather observer training seminars, sponsored by St. Louis County Emergency Management, are as follows: Basic SKYWARN Class: Mar. 21, 7 PM-10 PM; Apr. 10, 7 PM-10 PM; Apr. 22, 9PM-Noon. Advanced SKYWARN Class: Apr. 19, 7 PM-10 PM; Apr. 22, 1 PM-4 PM. Damage Assessment: Apr. 29, 1 PM-4 PM. All classes are open to everyone, and certification is provided. For more info, contact *Mike Redman KAOYXU, P.O. Box 16673, Clayton MO 63105. Tel. (314) 889-2362.*

APR 1

COLUMBUS, IN The Columbus ARC Hamfest will be held at Bartholomew County 4-H Fair Grounds, Family Arts Bldg., State Road 11, 8 AM-2 PM. Set-up Fri., Mar. 31st, 6 PM-10 PM. Talk-in on 146.790/.190. Make reservations through *Marion Winterberg WD9HTN, 11941 W. Sawmill Rd., Columbus IN 47201. Tel. (812) 342-4670.*

LEBANON, PA The Appalachian A.R. Group will host a Hamfest/Computer Show at Lebanon Fairgrounds, starting at 8 AM. VE Exams begin promptly at 9 AM (gather at 8:30 AM); pre-reg. requested. Lateness will result in disqualification. A fee payable to "AARG" will be collected at the Exam. Please bring original and a copy of your current license, and two forms of I.D. Registration deadline is Mar. 1st. Contact *Roger Engle WN3U, 979 Radio Rd., Elizabethtown PA 17022. Tel. (717) 367-2230.* Talk-in on 146.04/.64. Send check for Flea Market reservations to *AARG, 105 Walnut St., Pine Grove PA 17963. Tel. (717) 345-3780;* or *Lanny Hoffman KD3TS, 337 N. 19th St., Lebanon PA 17042. Tel. (717) 274-2148.*

LONGMONT, CO The annual LARCFEST will be sponsored by the Longmont ARC, 8 AM-3 PM, at Boulder County Fairgrounds, Hover and Nelson Rds. VE Exam at 1 PM. Talk-in on 147.27/.87 and 146.52. Contact *Randy Stevens N0NMD, 5280 Cypress Dr., Boulder CO 80303. Tel. (303) 499-1106.*

NORWICH, CT A Saturday Ham Radio Auction will be sponsored by the Radio Amature Soc. of Norwich, beginning at 10 AM. Setup at 9 AM. Talk-in on 146.730(-). Bring your gear to sell. For details, call *Tony AA1JN, (203) 859-0162;* or *Mike N1HFX, (203) 546-9498.*

ROCHESTER, MN The Rochester ARC will sponsor their 18th annual Rochester Area Hamfest/Computer & Electronics Show. VE Exams. Flea Market. Speakers and programs. Contact *Rochester ARC, Attn.: Frank Ingram N0MXN, 1627 5th Ave. SE, Rochester MN 55904. Tel. (507) 288-6569.*

SPOKANE, WA The Eastern Washington SECTION Hamfest and Computer Show will be held at Spokane Interstate Fairgrounds, N. 404 Havana. The Inland Northwest Hamfest Assn. will sponsor this event 9 AM-5 PM. Setup Fri., Mar. 31st, 9 AM-6 PM. VE Exams. Seminars. Contact *Warren Kelsey KJ7BB, S. 1405 Crestline, Spokane WA 99203. Tel. (509) 534-8443.*

TEANECK, NJ The Chestnut Ridge RC will hold its annual Flea Market, 8 AM-2 PM, at the Saddle River Reformed Church Education Bldg., East Saddle River Rd., corner Weiss Rd., Upper Saddle River NJ. Talk-in on 146.955 Rptr. Contact *Jack Meagher W2EHD. (201) 768-8360.*

APR 2

MADISON, WI The 23rd annual Madison Swapfest, sponsored by the Madison Area Rptr. Assn., will be held at the Dane County Expo. Center Forum Bldg. Doors open at 8 AM. Setup at 7 AM. Ask about special Sat. set-up time. Talk-in on the M.A.R.A. Rptr. WB9AER, 147.75/.15. Reservations deadline is Mar. 20th. Contact *M.A.R.A., P.O. Box 8890, Madison WI 53708-8890.*

TRENTON, NJ The 23rd annual Hamfest "Hamcomp '95" will be sponsored by the Delaware Valley Radio Assn. at Trenton State College. Admission at 7:30 AM. Setup at 6:30 AM. Talk-in on 146.67(-) and 442.650(+). For info contact *HAMCOMP '95, DVRA, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240.*

APR 8

FERGUS FALLS, MN The Lake Region AC will sponsor their 8th annual ARRL affiliated Hamfest, 8 AM-3 PM, at the Hocky Arena, Otter Tail County Fairgrounds. Set-up Fri., Apr. 7th, at 4 PM. VE Exams, ARRL Forum, MARS, Packet. Talk-in on 146.040/.640. Please contact *Wm. Morgan, Rt. 6 Box 43, Fergus Falls MN 56537.*

GREEN BAY, WI A Ham Radio & Computer Flea Market will be held at Ashwaubenon H.S., 2391 So. Ridge Rd. Sponsors: Ashwaubenon H.S. Tech Club and Brown County ARES. Set-up Apr. 7th, 7 PM-10 PM. VE Exams; register 8 AM-9 AM. Talk-in on 147.075(+). Contact *Chad Stiles N9PAY, 2171 Barberry Ln., Green Bay WI 54304. Tel. (414) 494-2936;* or *Lisa Kolbusz N9VJL, 520A Columbia Ave., Green Bay WI 54303. Tel. (414) 497-1807.*

JOPLIN, MS The Joplin ARC will hold HAMFEST '95 at the John Q. Hammons Trade and Convention Center, 3615 S. Rangeline (adjacent to the Holiday Inn). Time: 8 AM-3 PM. Set-up at 6:30 AM. ARRL Exams at 10:30 AM (pre-reg. not reqired). Bring original current license or CSCE, copies of license, and a photo ID. Talk-in on 147.210(+). For reservations and info, call *Larry Hendrix WB0OYU, (417) 782-5848 eves.,* or *Andy Gabbert KA0TUD, (417) 673-8371.* Address mail order requests for tickets to *ATTN: HAMFEST '95, Joplin ARC, P.O. Box 2983, Joplin MO 64803.* Must be received by Apr. 1st.

LAWTON, OK The Lawton Ft. Sill ARC will hold the 49th annual LFSARC Hamfest 8 AM-5 PM at the Comanche County Fair Grounds. Talk-in on 146.91/.31. Contact *Bob Morford KA5YED, 1415 N.W. 33rd St., Lawton OK 73505;* or *(405) 355-6120.*

PICKERING, ONT. CANADA The Durham Region AR Hamfest will be co-hosted by the South Pickering ARC and North Shore ARC at the Metro East Trade Centre. Talk-in on 147.375/.975 and 147.120/.720. Contact *David Herve, South Pickering ARC, P.O. Box 53, Pickering ON L1V 2R2. Tel. (905) 837-2127;* or *FAX (905) 831-5556.*

PORTLAND, ME The Portland (Maine) Amateur Wireless Assn. will sponsor a Hamfest and Electronics Flea Market, at the Univ. of Southern Maine, Sullivan Gymnasium, on Falmouth St. Doors open 8 AM-1 PM. Set-up 6:30 AM-8 AM. VE Exams 11 AM. Talk-in on 146.73/.13. Contact *Marty Feeney K1OYB, (207) 772-1682.*

WEST ORANGE, NJ A Hamfest will be held by the Irvington-Roselland AC, 8 AM-2 PM, at West Orange H.S., 600 Pleasant Valley Way. Set-up 6:30 AM. Talk-in on W2QR Rptr. 147.415/146.415; 146.520 simplex. Call *Jim Howe N2TDI,* or *Liz Howe N2WGH,* at *(201) 402-6066.*

APR 9

FRAMINGHAM, MA The Framingham ARA will hold its Spring Flea Market and VE Exams at Framingham H.S., A St. Doors open 9 AM for early bird buyers and 10 AM to all buyers. Set-up starts at 8 AM. To reserve tables, contact *Lew Nyman K1AZE, (508) 879-7456.* Send check payable to *FARA, P.O. Box 3005, Framingham MA 01701.* Talk-in on 147.15 Rptr.

RALEIGH, NC The Raleigh ARS will present its 23rd Hamfest/Computer Fair in the Jim Graham Bldg., NCS Fairgrounds, 8 AM-4 PM. ARRL, MARS, ARES, NTS, DX, and more. Pre-reg. VE Exams/AA4MY, *(919) 847-8512.* Hamfest contact: *Rollin Ransom NF4P, 1421 Parks Vill. Rd., Zebulon NC 27597. Tel. (919) 269-4406.* Talk-in on 146.04/.64.

ROCKFORD, IL An Electronics Expo & Ham Fest will be held 8 AM-1:30 PM by the Rockford ARA. Set-up 5 AM. Location: Rockford Metro Centre, 300 Elm St. Talk-in on 146.01/.61. VE Exams. Flea Market. Ham Gear. Computers, Software. Electronics Commercial Booths. Write to *RARA, P.O. Box 8465, Rockford IL 61126,* or call *Wayne or Fay, (815) 397-6027.*

APR 15

GOOCHLAND, VA The 3rd annual S.M.A.R.T. Swapfest will be held at Goochland County Fairgrounds, RT 522 & 632, 8 AM-3 PM. VE Exams at Noon. Talk-in on 53.06(-) and 147.27(+). Contact *Buddy Travis KA4NNN, (703) 894-0406.* Sponsor: Six Meter A.R. Team.

MUSKEGON, MI The Muskegon County ARES and RACES organization will conduct a HAMFEST and VE Exams at the Pulaski Lodge, 871 Pulaski, off Henry St., 8 AM-2 PM. Talk-in on 146.82 (-). Contact *Greg Hoffman N8RXB, P.O. Box 5313, North Muskegon MI 49445. Tel. (616) 759-8786.*

APR 16

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Flea Market 9 AM-2 PM at Albany and Main St. Set-up at 7 AM. For info and reservations call *(617) 253-3776.* Mail advance reservations before the 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/444.725 pl 2A, W1XM/Rptr.

APR 22

CLARKSTON, WA The 5th Annual Lewis-Clark Hamfest/Computer Fair will be held 8 AM-4 PM at Walla Walla Comm. College (Clarkston Center Campus), West End Bridge St. Flea Market, Seminars, VE Exams. Contact *Ken Anderson KB7IAW, 840 Grelle Dr., Lewiston ID 83501. Tel. (208) 743-9569 days;* or *(208) 743-1074 eves.* Talk-in on 146.36/.96.

TALLADEGA, AL The Talladega RAC will present their "TRACFEST" at the Nat'l Guard Armory. Doors open at 9 AM. VE Exams 10:30 AM. Flea Market. Contact *JT Martin, 4181 Allison Mill Rd., Talladega AL 35160. Tel. (205) 362-0478;* or call *Linda Pettis, (205) 362-5212.*

APR 23

BOOTHWYN, PA The Penn-Del ARC will hold their annual Hamfest 8 AM-2 PM at the Nur Temple on Route 13 in New Castle DE. Setup at 6 AM. Talk-in on 147.225(-) or 224.220/Rptr. Tables by reservation only, with payment to *Penn-Del Hamfest 95, P.O. Box 1964, Boothwyn PA 19061.* VE Exams; registration 9 AM. ARRL Forum 11 AM. Contact *Hal Frantz, (302) 798-7270.*

PITTSFIELD, MA The Northern Berkshire ARC will hold an indoor-outdoor Hamfest/Flea Market at Taconic H.S., Valentine Rd., 8 AM-2 PM. Setup 7 AM. VE Exams 9:30 AM, walk-ins ok. Talk-in on 146.91. Contact *Chuck Lowery NZ1Z, (413) 447-8377.*

SULLIVAN, IL A Hamfest will be held by the Moultrie A.R. Klub at the Moultrie/Douglas County Fairgrounds (near the Arthur H.S.) in Arthur IL. Setup Sat., Apr. 22nd Noon-4 PM; Sun., 6 AM-8 AM. Payment for Flea Market tables must be received in advance. Send reservations to *M.A.R.K., P.O. Box 91, Lovington IL 61937;* or call *Ralph Zancha WC9V, (217) 873-5287, eves./wkends.* VE Exams by pre-reg. only, 9 AM-Noon. Deadline Apr. 18th. Talk-in on 146.055/.655 and 449.275/444.275.

APR 28

KETTERING, OH The Southwest Ohio Chapter of the Quarter Century Wireless Assn. will hold its 1995 Annual Banquet at Alex's Continental Restaurant. C.O.D. bar at 7 PM; Banquet at 7:30 PM. Program: "Keys to the Success of the Wright Brothers." Reservation deadline Apr 26th. QCWA membership not a requirement. For tickets ($15.00 ea.) make check payable to *Robert L. Dingle, Treas. Chapter 9,* and mail to *1117 Big Hill Rd., Kettering OH 45429-1201.*

SPECIAL EVENT STATIONS

APR 6-7

DANBURY, CT The 1995 Connecticut QSO Party will be sponsored by the Candlewood ARA, 2000Z May 6th-2000Z May 7th, with a rest period 0400Z-1200Z. CW: 40 kHz up from lower band edges; Novices 25 kHz up from low end. Phone: 1.860, 3.915, 7.280, 14.280, 21.380, 28.380. VHF: 50.150, 144.200, 146.580. For operating rules write with SASE to *CARA, P.O. Box 3441, Danbury CT 06813-3441, USA.*

APR 8

STREATOR, IL The Streator ARC will Operate Station K9CAU to commemorate the 50th Anniversary of the Streator Hobby Show. Operation will be from 0900 UTC-2300 UTC on the 40 and 20 meter General phone band. For a certificate, send SASE to *N9PLM, 1705 Florence St., Streator IL 61364-1337 USA.*

APR 8-9

CALIFORNIA D.O.T. As part of the Dept. of Transportation's Centennial (1895-1995) events, volunteer members of Headquarters and the 12 District Caltrans Auxiliary Radio System (CARS) Stations, using various call signs, will be operating from 1600Z-0100Z Apr. 8-9. Operations will be in the General portion of the 10, 15, 20, and 75m bands and Novice/General of the 40m band. 2 meter voice contacts on 146.52 simplex, and packet on 145.05 MHz. A commemorative QSL card, with special postal stamp cancellation will be available for contacts made. For info, call *Carol Dulay N6WCV, (916) 654-8884.*

APR 12-13 & 15

HYDE PARK, NY The Franklin D. Roosevelt Presidential Library, in commemoration of the 50th Anniversary of the death of President Roosevelt, is pleased to announce that the Poughkeepsie ARC will set up a working internat'l radio station and historical exhibit at the presidential library in Hyde Park NY. Operations will commence on Wed. Apr. 12th at 1300Z and continue until Apr. 13th at 0100Z. Operations will also be on Apr. 15th 1300Z-2100Z. Station W2CVT is planning to operate on or near the following frequencies (MHz): 7.045, 7.175, 14.045, 14.245, 21.045, 21.310, 146.550, and on the YCCC Packet Cluster. For a certificate and QSL, SASE to *Herbert Sweet, 6 Covey Rd., Hyde Park NY 12538, USA.*

APR 17

SOMERSET, PA The Somerset County ARC will operate Station NJ3T from the Somerset County PA Courthouse, in celebration of the founding of Somerset County 200 years ago. Operations will be from 10 AM-5 PM. Listen for them on the lower 50 kHz of the General class phone bands on 40m 10 AM-1 PM; and 20m 1 PM-5 PM; also 14.105 Packet the entire time. For a QSL card, send QSL and SASE to *James Crowley NJ3T, RD. 5, Somerset PA 15501, USA.*

APR 21-22

KIMBERLING CITY, MO The Kimberling ARC will operate NQ0G 1600Z-2100Z on the lower portions of the 10, 20, and 40m bands. Their CW station will be on 14030-40 and 7125-50 Apr. 21st and 22nd, to celebrate the Inauguration of Kenny Rogers SHOWBOAT, the "Branson Belle." For a certificate, send an SASE to *KARC, P.O. Box 1171, Kimberling City MO 65686, USA.*

APR 22

BELLEVUE, NE The Bellevue ARC will operate W0WYV from 1100Z-2300Z to celebrate the 35th Anniversary of the founding of the Club. SSB operation will be in the lower phone portion of the General 40, 20, and 17m bands, and if propagation permits, in the Novice portion of the 10m phone subband. CW operation will be in the Novice portion of the 40m band. For an unfolded certificate, send your QSL card with contact number and a large 9" x 12" SASE, to *Bellevue ARC, c/o Larry Bailey W0PYA, 1110 Lincoln Rd., Bellevue NE 68005, USA.*

CORWALL, ENGLAND In celebration of Marconi's birthday, the Cornish RAC will sponser over 25 SE Stations representing the locations of early Marconi experiments and transmitting stations, including: CT1TGM, DA0IMD, EI2IMD, EI4IMD, and many more. There will be a certificate for working 12 stations. For more details, contact *G4USB@GB4AKE.#44.GBR.EU* or the *Cornish R.A.C., Box 100, Truro TR1 1RX, Cornwall, England.*

APR 22-23

TULSA, OK The Tulsa ARC will sponsor the Route 66 QSO Party by operating Station W5OK in celebration of the heritage of Route 66. Operation will be from Ollie's Restaurant, the site of the first oil well in Tulsa. W5OK will operate 1800Z Apr. 22nd-1800Z Apr. 23rd. Phone: lower 50 kHz of the General 15, 20, 40, and 80m subbands and the Novice 10m subband. There will also be a 2m SSB station. CW: lower 25 kHz of the General 20, 40, and 80m subbands and the Novice 15m subband. For a certificate, send QSL and a 9" x 12" SASE to *Tulsa ARC, P.O. Box 4283, Tulsa OK 74159, USA.*

APR 28-29

THOMASVILLE, GA Station W4UCJ will be operated by the Thomasville ARC, 1700Z-2300Z Apr. 28th, and 1100Z-2000Z Apr. 29th, to commemorate the 74th annual Rose Festival. Operation will be in the lower portion of the General 80, 40, 20, and 15m phone subbands, and the Novice 10m phone subband. For a certificate, send QSL and a 9" x 12" SASE to *TARC/Rose Festival Station, P.O. Box 251, Thomasville GA 31799, USA.*

What Does It Take...

...to get you to subscribe to *73?* Sure, we could give you a lot of history to show how *73* has had a powerful influence on ham radio as it is today. But what you want to know is what can *73* do for you right now.

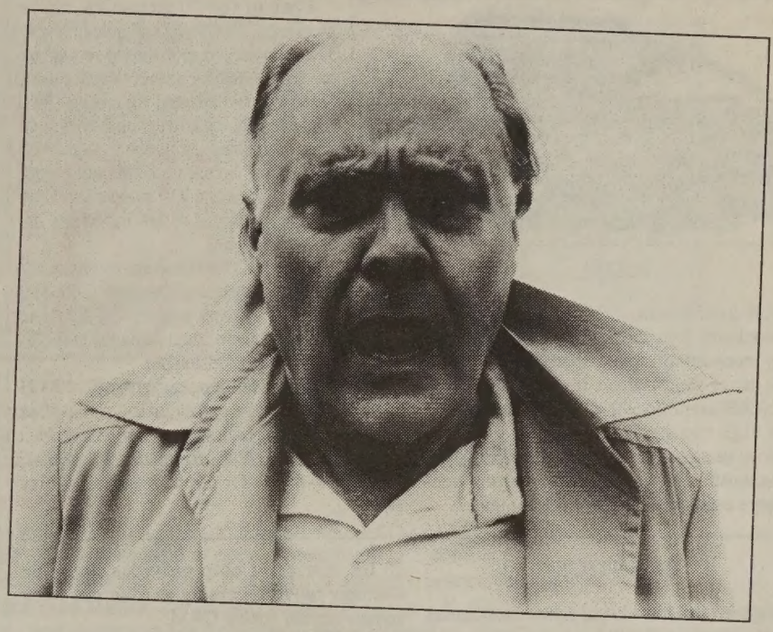
1) One of the most fun parts of hamming is buying a new piece of gear and using it. But you sure want to know all you can about it before buying, right? *73* has more equipment reviews than any other ham rag, and almost always has 'em first.

2) Unless you're a real nerd, you want to know how to get active on packet, the ham satellites, slow-scan, and all the other exciting adventures amateur radio has waiting for you. *73* has been the leader in new ham modes ever since it started. And Wayne was doing the same thing when he started *Amateur Radio Frontiers* magazine in 1951. He was pushing ham teletype then. Still is, for that matter. Then, as the editor of *CQ* for five years, he pushed SSB and NFM. Then, after being fired because *CQ* owed him too much money, he started *73,* where his long editorials have been urging hams to try new things, learn more, and be entrepreneurs, since 1960. Wayne's editorials have helped hundreds of hams become millionaires.

3) One of the more fun things in hamming is building gadgets. *73* has more simple construction projects than the other ham rags combined. Plus lots of reviews of kits. You'll have a ball with some of the QRP rigs and kits.

4) Antennas? You'll read about a ton of new ideas in antennas. Here's one area of hamming that you can experiment with and have fun.

5) Wayne's done just about everything there is to do in hamming, and he generally helped pioneer new modes. He's visited over 130 countries and operated from over half of them. He went on his first DXpedition in 1958 to Navassa as KC4AF. Almost got killed. So when he writes his editorials urging you to try something new, he's usually done it himself.



6) Once you start reading his editorials you'll be hounding the flea markets for back issues. With over a thousand of his provocative, and often controversial, editorials published so far, that'll keep you busy for a while. Wayne sure says what he thinks. But he does his homework first, so the chances are that if you don't agree with him, it may be you who needs to do the homework, not him. Wayne predicted the cellular telephone industry before it happened. He did the same with microcomputers, starting the first magazine in the field, and then with compact discs, again with a magazine. He's into cold fusion now with a new magazine. It costs $98 a year for a subscription, so you'll probably cry poverty and miss the next huge industry that's about to get started, and miss out on being a millionaire again. Tsk. But that's the price for being chintzy.

7) Speaking of chintzy, you might enjoy reading about Wayne's travels. He calls it being thrifty. He's written several of these travelogs with the day-to-day stories of his trips. You'll enjoy them. Check the Uncle Wayne's Bookshelf ad for details. You could do worse than read his ***Declare War*** book too. Thousands of hams have read and enjoyed it.

8) Meanwhile, at least read *73* so you can keep up with what's happening.

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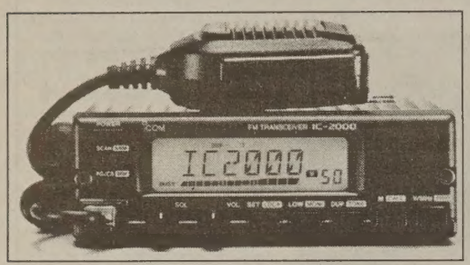
new products



ICOM

Icom has introduced the IC-2000H superior wideband 2 meter mobile featuring clear, crisp reception designed specifically to deal with cross modulation interference. The IC-2000H employs a tracking tuning system with high quality RF band pass filters to improve image rejection and intermodulation characteristics. Now you can persue your hobby more easily in high RF environments.

Each of the 50 memories can be programmed with a six-character name. This allows you to instantly recognize the frequency by name, which eliminates confusion and mistakes. Two scratch pad memories and two scan edge memories are also available. With 50 watts of output you can easily work distant repeaters. The power level can also be adjusted to 10 or 5 watts for closer stations.

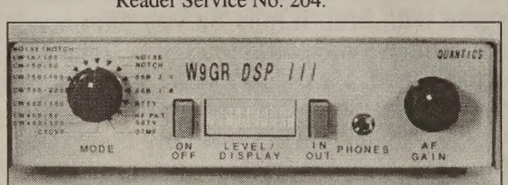
The IC-2000H has many more advanced features. Optional features include a UT-55 alpha message pager, UT-85 tone scanner, UT-101 code squelch/pager and UT-85 tone squelch/pocket beeper.

The suggested retail price for the IC-2000H is $430. For more information visit your favorite dealer or contact *Icom America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.

QUANTICS

Quantics has introduced a low cost digital signal processor (DSP) kit for amateur use: the DSP-3. This kit incorporates many suggestions and requests made by users of the original W9GR DSP-1 kit. The popular DSP-1 has been built by thousands of amateurs.

The new DSP-3 kit has 18 DSP functions selectable by a rotary switch, including various combinations of noise (QRN) reduction and heterodyne removal (automatic notch filtering), a DTMF tone decoder with memory, seven tunable CW filters, and various filters for FSK, SSTV, and narrow SSB. A 13 bit converter chip provides the wide dynamic range necessary to filter out weak signals amidst strong QRM.



The DSP-3 kit is priced at $149, and the optional metal cabinet is $19. (California Residents add sales tax) Shipping and handling is $7 in the USA and Canada. For more information contact *Quantics, P.O. Box 2163, Nevada City, CA 95959-2163.* Or circle Reader Service No. 204.

S & S CABLE

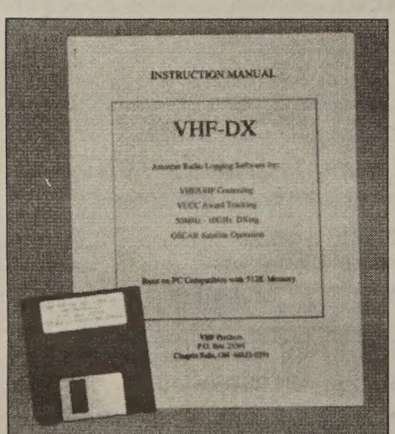
Amateurs who like to make their own wire antennas can really appreciate a high quality copper wire that is so flexible you could use it to lace your shoes. S & S Cable has introduced this new antenna wire, designed specifically for high efficiency and ease of installation. This #12 gauge pure copper 413-strand "rope lay" is essentially wire rope specially made for extreme flexibility and resistance to kinking.

This new product offers lower resistance, larger skin surface area, and greater mechanical strength than all the standard wire previously offered. Pure copper will never rust and is nearly impervious to extreme weather. The 413-strand rope lay cannot kink and stretches only 0.2% under a 150 LB test, which would cause only a 2.77" change in a 133' 80 meter dipole, or a 6 kHz change in resonance.

To receive a free sample of the #12 gauge, 413 strand wire rope antenna wire, send a SASE with two units of postage to the address shown. For more information contact *S & S Cable Co., 9010 Forbes Ave., Northridge, CA 91343; (818) 995-0803.* Or circle Reader Service No. 207.

VHF PRODUCTS

If you are planning to participate in an upcoming VHF contest, a logging program designed specifically for the unique requirements of VHF/UHF operation is now available from VHF Products. "VHF-DX" provides logging and scoring functions for the ARRL VHF/UHF contests, including the Spring Sprints. The program identifies new grids, dupe checks, logs rovers, displays QSO and grid count by band (50 MHz to 10 GHz), and has real time scoring. After the contest, the complete log entry and summary sheet are automatically generated to a disk file or hard copy, ready to submit.



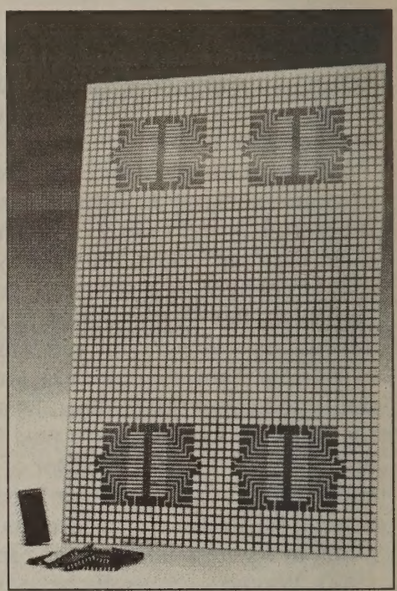
VHF-DX runs on PC compatibles with 512K and includes a program disk and printed instruction manual. The price is $10.95 plus $1 for shipping (please specify type of disk). For more information contact *VHF Products, P.O. Box 23391, Chagrin Falls, OH 44023; (216) 543-2748.* Or circle Reader Service No. 206.

ECODE SYSTEMS

Surfboard is a unique surface mount prototyping board being introduced by ECode Systems. Surfboards offer variable size SIOC pads for design and prototyping flexibility. The unique pad layout allows easy and reliable mounting of both wide (400 mil) and narrow (300 mil) body SIOC styles while accommodating up to 32 pins.

The 100 mil matrix of 80 mil squares is specifically designed to permit chip resistors, capacitors, inductors, SOT style semiconductors and even DIP packages to be mounted with ease.

Surfboard is made in the USA to exacting standards and utilizes the highest quality components such as FR4 (Fiberglas epoxy laminate) and solder plating over 1 ounce copper on both sides. Single units are priced at $19.95 with quantity discounts available. For more information contact *ECode Systems, Inc., 7050 North Wilder Road, Phoenix, AZ 85021; (602) 870-8063, FAX (602) 371-8736.* Or circle Reader Service No. 202.



SIRIO

Sirio Antenna of Milan, Italy—long known throughout Europe for its fine communications antennas, is now being introduced to the North American market by Electronic Distributors. With a very wide range of antenna products for the radio amateur as well as for virtually every radio service, this manufacturer is renowned for excellent engineering, high caliber construction, and attention to detail.

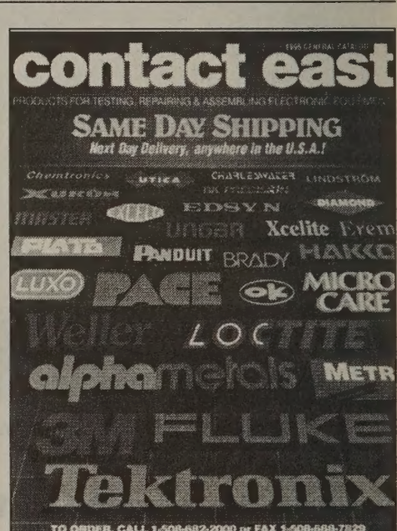
A full color brochure is now available. For more information please visit your favorite dealer or contact *EDCO, 325 Mill Street NE, Vienna, VA 22180; (703) 938-8105, FAX (703) 938-4525.* Or circle Reader Service No. 205.

CONTACT EAST

The new 1995 catalog is now available free from Contact East, featuring test equipment, tools, and supplies. This 144 page issue is packed with hundreds of new test instruments and tools for amateurs and others. Featured are quality products from brand name manufacturers for testing, repairing, and assembling electronic equipment.

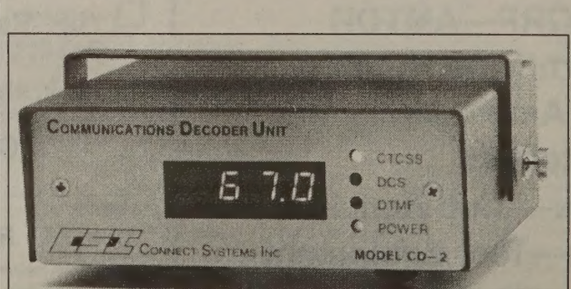
Product highlights include new DMMs and accessories, certification for Fluke multimeters, soldering tools, custom tool kits, EPROM programmers power supplies, ELF meters, adhesives, hand tools, workbenches, and much more.

All products are fully guaranteed and orders placed by 4 PM are shipped by 5 PM. To receive your free catalog contact *Contact East, Inc., 355 Willow Street South, North Andover, MA 01845-5995; (508) 682-2000.* Or circle Reader Service No. 203.



CONNECT SYSTEMS

Connect Systems has unveiled a new model communications decoder which decodes and displays 50 CTCSS codes, 104 DCS codes and all 16 DTMF digits. Model CD-2 can be used in conjunction with scanners, communication receivers, and service monitors to decode the on-the-air communications codes.



In addition to the data on the LED panel, all decoded data is available on the RS-232 serial port. An optional PC compatible software applications program (CD-2P) allows you to view all decoded data on your computer and also acquire time, dates, and hits per CTCSS or DCS code plus usage graphs. DTMF characters are decoded in strings up to 128 characters in length.

For more information contact *Connect Systems, Inc., 2259 Portola Road, Ventura, CA 93003.* Or circle Reader Service No. 208.

DAYTON hamvention® '95

April 28, 29,30, 1995

General Chairman, Ken Allen, KB8KE

Asst. General Chairman, Dick Miller, N8CBU

✷ Giant 3 day Flea Market ✷ Exhibits ✷ Activities for the Non-Ham

When and Where

April 28, 29 and 30, 1995; Dayton, Ohio at Hara Arena

Communications

FAXMail (information sent to you via FAX): (513) 276-6934

BBS via America Online: Keyword "Ham", Select "Hamvention"

PHONE: (513) 276-6930. For fast response, please obtain the committee Voice Mail box numbers via FAXMail or BBS.

FAX (incoming): (513) 274-8369

MAIL: Hamvention, Box 964, Dayton, Ohio 45401-0964

Special Services

Lodging information and special award nomination forms are in our 1994 Program. Call FAXMail or BBS for more information.

License Exam by appointment only. Call FAXMail or BBS for details.

Deadlines

In order to have time to return tickets to you, we must have advanced reservation orders postmarked not later than April 8 (USA) or April 1 (Canada). Tickets will not be mailed before January 15th, 1995. Ticket requests that are received **AFTER** the deadline will be processed and **HELD** for pick-up at Hara Arena. Tickets can be picked up beginning Thursday, April 27 at 8:00 a.m.

Flea Market

Flea Market Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. A maximum of 3 spaces per person (non-transferable). Electricity is available in a portion of the last Flea Market row for $40 additional per space. Rental tables and chairs are not available in the Flea Market. Vendors ***MUST*** order an admission ticket for each person when ordering Flea Market spaces. Please send a separate check for Flea Market space(s) and admission ticket(s). Spaces will be allocated by the Hamvention committee from orders received by February 1. Please use 1st class mail *only*.

Notification of Flea Market space assignment will be mailed by **March 15, 1995**. Checks will not be deposited until after the selection process is complete. Please indicate in the box below if you would like to attend regardless of Flea Market space assignment.

Free bus service

Free bus service will be provided between Hamvention, Air Force Museum, Salem Mall and Forest Park Mall parking areas. We are investigating ways to improve service to hotels. Please call our BBS or FAXMail for specific information.

Returned Checks

A $20 service charge will be assessed on all returned checks.

HAMVENTION Is sponsored by the Dayton Amateur Radio Association Inc.

Advance Registration

Enclose check or money order for amount indicated in U.S. dollars and type or print your name and address clearly.

Make checks payable to:

Dayton HAMVENTION Mail to -
Dayton Hamvention Box 1446, Dayton, OH 45401-1446

Flea Market tickets *Please check one and enclose **two** checks.*

❑ Send admission tickets **only** if flea market space(s) assigned.

❑ Send admission tickets **regardless** of flea market space assignment.

		How Many		
Admission (valid all 3 days)		_____ @ $12.00*	$_____	
Grand Banquet		_____ @ $23.00**	$_____	
Alternate Activities				
Saturday Luncheon		_____ @ $9.00	$_____	
Sunday Luncheon		_____ @ $8.00	$_____	
Flea Market ‡		_____ $35/1 space		
(Max.3 spaces)		_____ $70/2 adjacent		
		_____ $160/3 adjacent	$_____	
Electricity	add	_____ $40.00/space	$_____	
Covered tent		_____ $230.00 ea.	$_____	
			Total	$_____

Name _____ Call _____

Address _____

City _____ State _____ Zip+4 _____ – _____

Daytime Phone # ( )_____ Evening Phone # ( ) _____

* $15.00 at door
**$25.00 at door, if available
‡ Admission ticket must be ordered with flea market spaces

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International Edition

73 Amateur Radio Today

BUILD YOUR OWN!

Kit Builde
Polarity P
6m Vertic
Antenna
CW Oper
Friend

More 7

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Benc
Kenv
Kits
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Where Did "73" Come From?

How did hams get started using "73" as meaning "best regards?" It all seems to have started with the very first hams. Many of them had cut their teeth on the western land lines using Morse clickers. Out West a man's most prized possession was his Winchester 73 rifle, the "gun that opened the west." So it was natural for early telegraphers to "will their 73" at the end of messages. Soon they were just signing "73." And that's how come we hams got started using "73" and are still using it. CBers younger than their IQs, and obviously confused by numbers, sign with "sevens and threes."

Anyway, when I decided to start my own ham magazine in 1960, I looked for some term which was peculiar to hamming, and chose *73*. When I started the first microcomputer magazine I went the same route, picking *Byte* for my title.

So here we are in 1995, 35 years after I started *73*, and we're still going strong. This October will mark the 35th anniversary of my first issue. 420 issues! Not many magazines last that long. I got started in all this back in 1950, when I got interested in RTTY. The next thing I knew I was doing a monthly *Amateur Radio Frontiers* magazine with 2000 paid subscribers, and then a column in *CQ* on the subject. When I got the *CQ* editor a better job at Popular Electronics in 1955 I suddenly found myself editing *CQ*. Five years later, after being fired, I decided to start my own ham magazine.

I couldn't find anyone willing to gamble with me, so I sold everything I could and got together just barely enough money to print the first issue. The saga of the next 35 years has been chronicled in my editorials. Well, I enjoyed John Campbell's (W2ZGU) editorials in *Analog* so much I decided to use the same approach. So I've been writing about anything I find of interest for 35 years, from aardvarks to B'ahai. The inventor of the contact lens was a ham I knew while I was living in Sarasota, and into B'ahai. Another Sarasota ham, who worked with me at WSPB, the local radio station, was Bandle Linn K8LAP, a cartoonist who did my first *73* cover and many more cartoons down through the years.

For more details on my life, you'll have to read my old editorials, or at least invest in some of the books and booklets I've written.

.....Wayne

Last Chance!

One of the most valuable resources you'll ever have in amateur radio is your ham magazine back issue collection. Any time you get interested in a new facet of the hobby, all you'll have to go on are the articles that have been published. This is why no ham ever throws out his old ham magazines. Ever!

Serendipitously, I was looking through our warehouse the other day and found that we had quite a bunch of back issues sitting there. They aren't of much use to us here, and they can be almost beyond value to you, so here's your opportunity to help me clean up a corner of the warehouse and for you to get a bunch of great back issues.

In addition to a gold mine of my old editorials, you'll also find reviews of equipment which could help you decide when you're shopping for a used rig. We publish more equipment reviews in *73* than any other ham rag. We also have more simple construction projects, and so on. I don't fill the magazine up with stale club news and the results of long-forgotten contests. Each issue of *73* is full of stuff still of current interest, even when the magazine is a few years old.

I've got 75 different back issues still on hand. While they last, you can stock up for a dollar each, plus $5 for shipping and handling. $3 more if you prefer UPS. For $55 you can get a stack of 50 back issues, which will keep you busy for weeks just reading my editorials. For $30 I'll send you 25 choice back issues, and make you eat your heart out that you didn't send for the whole 75. By the time you find out that you've goofed and want to get the rest they'll be long gone. These are going to go fast.

No fair taking these to hamfests and selling them for $2 each. Tsk, have you no shame? Clubs should stock up on bundles of 25 to give as a prize to any new hams they get licensed, thus giving them a head start on their ham libraries.

I don't have a ton of these, so they won't last long.

Send cash, check, or your credit card number to *73* **Bonanza, 70 R 202 N, Peterborough NH 03458-1107.** Or call **603-924-0058** with your order to get to the head of the line. Or fax it to **603-924-8613.**

.....Wayne